



SIERRA LEONE

Annual Report

OF THE

Medical and Sanitary Department

For the Year 1931.

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Annual Report of the Medical and Sanitary Department for the year 1931.

I—Administration.

(a) ESTABLISHMENT, INCLUDING VACANCIES, ACTING APPOINTMENTS AND PROMOTIONS.

MEDICAL AND SANITARY STAFF.

- 1 Director of Medical and Sanitary Services.
- 1 Assistant Director of Health Service.
- 1 Surgical Specialist.
- 1 Senior Health Officer.
- 2 Senior Medical Officers.
- 1 Medical Officer of Health.
- 11 Medical Officers of the West African Medical Staff.
- 1 Lady Medical Officer.
- 8 African Medical Officers.
- 1 Sanitary Superintendent and Training Officer.
- 2 European Superintendent Sanitary Inspectors.

EUROPEAN NURSING STAFF.

- 2 Senior Nursing Sisters.
- 5 Nursing Sisters.

SUBORDINATE MEDICAL AND SANITARY STAFF.

- 1 Chief Dispenser.
- 1 Assistant Chief Dispenser.
- 10 First Class Dispensers.
- 10 Second Class Dispensers.
- 14 Third Class Dispensers.
- 1 Hospital Warden.
- 1 Chief Store-keeper.
- 2 Assistant Store-keepers.
- 33 Male Nurses and Apprentices.
- 25 Female Nurses and Probationers.
- 2 Midwives.
- 3 Health Visitors.
- 40 Sanitary Inspectors and Learners.
- 1 Dispenser for Infant Welfare Clinic.
- 1 Head Attendant, Lunatic Asylum.
- 1 Assistant Head Attendant, Lunatic Asylum.
- 1 Matron, Lunatic Asylum.
- 3 Female Attendants, Lunatic Asylum.
- 12 Male Attendants, Lunatic Asylum.
- 1 Laboratory Assistant.

There are in addition to the above, cooks, stokers, gate-keepers, watchmen, labourers, hospital porters, carpenter, motor-ambulance driver, etc.

CLERICAL STAFF.

There are eighteen clerks; 1 chief clerk, 1 first grade, 1 second grade, 10 senior third grade and 5 junior third grade.

TEMPORARY ASSISTANCE.

Owing to the shortage of Medical Officers due to invalidings, Dr. G. E. C. Reffell was engaged temporarily from 8th to 21st July, and again from 15th to 22nd September; also Dr. J. B. S. Baxter was engaged temporarily from 8th to 14th July.

PRINCIPAL ACTING APPOINTMENTS.

(Substantive Holders are given in Table I).

Dr. J. A. A. Duncan, acted as Director of Medical and Sanitary Services, from 2nd May to 1st October.

Dr. A. B. Monks, acted as Assistant Director of Health Service, from 2nd May to 1st October and again from 12th October to 31st December.

Dr. R. F. Campbell, acted as Senior Health Officer, from 1st January to 19th February.

Dr. W. Allan, acted as Medical Officer of Health from 22nd March to 15th May, and again from 19th December to 31st December.

Dr. H. J. Bermingham, acted as Medical Officer of Health, from 23rd May to 17th September.

Dr. R. B. Henderson, acted as Medical Officer of Health, from 19th September to 27th November.

NEW APPOINTMENTS.

Dr. T. H. Dalrymple, appointed Medical Officer on the 25th March, and arrived Freetown on the 3rd April.

Dr. W. A. Burnett, appointed Medical Officer on the 23rd September, and arrived Freetown on the 2nd October.

TRANSFERS.

Dr. M. M. McDowall, Lady Medical Officer, transferred to Gold Coast on the 17th June.

Dr. A. M. Wilson-Rae, Medical Officer, transferred to Sierra Leone from Gambia on the 1st October.

Dr. H. J. Bermingham, Medical Officer transferred to Bathurst Gambia on the 5th October.

Dr. G. L. Alexander, Medical Officer, transferred to Gold Coast in October.

Miss A. M. Pearton, Nursing Sister, transferred to Gold Coast on the 2nd December.

(b) LIST OF ORDINANCES, ETC., AFFECTING PUBLIC HEALTH
ENACTED DURING THE YEAR.

ORDINANCES.

Public Health (Protectorate) Amendment Ordinance, 1926, No. 8 of 1931.

Births and Deaths Registration (Amendment) Ordinance, 1924, No. 9 of 1931.

ORDERS IN COUNCIL.

Public Health (Infectious Diseases) Order in Council, No. 1 of 1931.

Health Districts (Pujehun and Yonni) Order in Council, No. 2 of 1931.

Dangerous Drugs Order in Council, No. 6 of 1931.

Protectorate Health Areas Order in Council, No. 20 of 1931.

GOVERNOR'S ORDERS.

Lunatic Asylum Order, No. 2 of 1931.

Lunatic Asylum Revocation Order, No. 3 of 1931.

(c) FINANCIAL.

The following table gives the revenue and expenditure for the years 1930 and 1931 :—

Medical Revenue.				1930.			1931.		
				£	s.	d.	£	s.	d.
Connaught Hospital receipts	...	...	...	163	17	6	211	4	7
European Hospital receipts	...	...	...	642	15	10	511	3	9
Sundry receipts (out-patients' fees, etc.)	...	...	...	904	6	4	617	19	0
Druggist fees (registration)	...	...	...	—			—
Maintenance of lunatics	...	...	...	346	5	11	290	12	1
Departmental fines	...	...	...	2	15	11	3	16	6
Total	...	...	...	£2,060	1	6	£1,634	15	11

Medical Expenditure.				1930.			1931.		
				£	s.	d.	£	s.	d.
Personal Emoluments	...	...	...	41,121	14	6	38,627	18	7
Other Charges	...	...	...	22,099	7	7	16,033	9	0
Total	...	...	...	£63,221	2	1	£54,661	7	7

Sanitary Revenue.				1930.			1931.		
				£	s.	d.	£	s.	d.
Sanitary Services	...	...	...	3	3	0	86	0	10
Maintenance of persons in quarantine	...	...	...	29	6	8	—		
Total	...	...	...	£32	9	8	£86	0	10

Sanitary Expenditure,				1930.			1931.		
				£	s.	d.	£	s.	d.
Personal Emoluments	...	...	...	10,222	19	10	10,113	4	4
Other Charges	...	...	...	12,884	4	8	11,605	16	10
Total	...	...	...	£23,107	4	6	£21,719	1	2

Ratios of combined Medical and Sanitary votes to total estimated revenue for the past five years :—

Year.				£	
1927	...	...	...	82,206	1 : 11·8
1928	...	...	...	88,365	1 : 11·07
1929	...	...	...	94,188	1 : 8·33
1930	...	...	...	97,975	1 : 7·86
1931	...	...	...	86,708	1 : 9·08

ANALYSIS OF HOSPITAL EXPENDITURE FOR THE YEAR 1931.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Institution.	Total Number of Patients.	Daily Average Number of Patients.	Hospital Days.	Provisions from Store-keeper.	Fresh Provisions.	5 and 6 per Patient per Day.	Wines, Spirits, Minerals, Tobacco, Ice.	8 per Patient per Day.	7 and 9 per Patient per Day.	Fuel, Light.	Miscellaneous: Cleaning Materials, Hospital Equipment, Replacements.	Total of 5, 6, 8, 11 and 12.	5, 6, 8, 11 and 12 per Patient per Day.	Total Sum Recoverable from Paying Patients.
Nursing Home ...	92	3.00	1,234	£ s. d. 114 8 4½	£ s. d. 199 1 10	£ s. d. 0 5 0¾	£ s. d. 60 11 2	£ s. d. 0 0 11¾	£ s. d. 0 6 0½	£ s. d. 60 5 7	£ s. d. 42 10 3¼	£ s. d. 476 17 2½	£ s. d. 0 7 8¾	£ s. d.
Connaught Hospital	2,335	93.00	34,040	£ s. d. 683 0 4	£ s. d. 915 12 11	£ s. d. 0 0 11¼	£ s. d. 30 16 11	...	£ s. d. 0 0 11¼	£ s. d. 340 10 4	£ s. d. 41 3 0¼	£ s. d. 2,011 3 6¼	£ s. d. 0 1 2	£ s. d.
Lunatic Asylum ...	154	92.79	33,787	£ s. d. 54 12 6	£ s. d. 614 5 0	£ s. d. 0 0 4¾	£ s. d. 17 10 9	...	£ s. d. 0 0 4¾	£ s. d. 31 18 6	£ s. d. 21 13 2½	£ s. d. 739 19 11½	£ s. d. 0 0 5¼	£ s. d.
Kissy Infirmaryes ...	220	80.89	29,478	£ s. d. 45 2 3	£ s. d. 576 13 9	£ s. d. 0 0 5	£ s. d. 13 4 9	...	£ s. d. 0 0 5	£ s. d. 55 16 0	£ s. d. 18 15 5½	£ s. d. 709 12 2½	£ s. d. 0 0 5¾	£ s. d.
Bonthe Hospital ...	359	21.75	8,232	£ s. d. 27 12 7	£ s. d. 180 19 0	£ s. d. 0 0 6	£ s. d. 2 19 7	...	£ s. d. 0 0 6	£ s. d. 13 11 1	£ s. d. 9 1 10	£ s. d. 234 4 1	£ s. d. 0 0 6¾	£ s. d. 9 7 6

II—Public Health.

(a) GENERAL REMARKS.

(i) GENERAL DISEASES.

The comparative tables of sick and invaliding rates show that 1931 was rather less satisfactory from the general health point of view than the preceding year, though the reduction of total cases treated from 100,355 to 94,859 might give a contrary impression. No serious epidemics occurred, except an outbreak of what was at first diagnosed as Beriberi in some of the Government institutions.

European Officials.—Table I shows a small increase in the sick rate and a larger one in the invaliding rate, but the latter was exceptionally low in 1930. One death from Blackwater fever has to be recorded, but the number of cases of malaria for both in-patients and out-patients shows a happy reduction in the incidence of this disease.

TABLE I.
HEALTH OF EUROPEAN OFFICIALS.

Tables showing Sick, Invaliding and Death-rates of European Officials.

	1929.	1930.	1931.
Total number of officials resident	302	296	261
Average number resident	251	260	177
Total number on sick list	198	187	151
Total number of days on sick list	1,935	1,785	1,463
Average daily number on sick list	5·3	4·89	4·00
Percentage of daily sick to average number resident ...	2·11	1·88	2·25
Average number of days on sick list to each patient ...	9·77	9·54	9·68
Average sick time to each resident	7·7	6·86	8·26
Total number invalided	11	3	8
Percentage of invalidings to total residents	3·43	1·01	3·06
Percentage of invalidings to average resident	4·38	1·15	4·51
Total number of deaths	1	—	1
Percentage of deaths to total residents	·31	—	·38
Percentage of deaths to average number residents ...	·4	—	·56

Causes of Invalidings and Deaths of European Officials.

Causes.	Invalided.	Died.
Appendicitis	1	—
Asthma	1	—
Blackwater fever	—	1
Haemoptysis	1	—
Malaria	2	—
Tumour	1	—
Ulcer duodenum	1	—
Ulcer tongue	1	—
Total	8	1

The invaliding rate of European Officials for the past ten years is shown below :—

Year.			Average Number Resident.	Total Number of Invalidings.	Percentage of Invalidings to Average Resident.
1922	...	...	109	5	4.58
1923	...	...	102	14	13.72
1924	...	...	164	13	7.92
1925	...	...	180	5	2.77
1926	...	...	184	6	3.26
1927	...	...	250	16	6.40
1928	...	...	280	9	3.21
1929	...	...	251	11	4.38
1930	...	...	260	3	1.15
1931	...	...	177	8	4.51

European Non-Officials.—Table II shows a marked increase in the number of European non-officials on the sick list, and a smaller increase in the number of invalidings over the previous year. The large increase in the total number resident is surprising in view of the heavy retrenchment in staff of the trading firms but is largely accounted for by the mining developments in the Protectorate. Also the wives of Government Officials have been added to this list, which does not appear to have been done before. The increase in sick-rate may be partly accounted for by the living conditions in mining camps, and perhaps to some extent to the increased strain thrown on those left, by the reduction of working staffs in the trading firms.

An unusual entry is found in the causes of death, “Unknown.” The deceased was working single handed for a small firm in an isolated part of the Protectorate, and was struck down before medical aid could reach him.

TABLE II.
HEALTH OF EUROPEAN NON-OFFICIALS.
Table showing Sick, Invaliding and Death-rates of European Non-Officials.

					1929.	1930.	1931.
Total number of non-officials resident	...	...	...	...	420	398	494
Average number resident	...	...	...	...	325	318	343
Total number on sick list	...	...	...	...	48	40	75
Percentage of sick to average number resident	...	...	...	...	15.73	12.57	21.86
Average number of days on sick list to each patient	...	...	...	...	—	—	—
Average sick time to each resident	...	...	...	...	—	—	—
Total number invalided	...	...	...	...	17	8	11
Percentage of invalidings to total residents	...	...	...	...	4.14	2.01	2.22
Percentage of invalidings to average number resident	...	...	...	...	5.23	2.51	3.20
Total deaths	...	...	...	...	5	5	3
Percentage of deaths to total residents	...	...	...	...	1.19	1.25	.60
Percentage of deaths to average number resident	...	...	...	...	1.53	1.57	.84

Causes of Invalidings and Deaths of European Non-Officials.

Cases.						Invalided.	Died.
Alcoholism	...	...	...	...	...	—	1
Anemia	...	...	...	...	...	1	—
Dropsy	...	...	...	...	...	1	—
Hernia	...	...	...	...	...	1	—
Kidney Trouble	...	...	...	...	...	1	—
Malaria	...	...	...	...	...	5	1
Rupture of Spleen	...	...	...	...	...	1	—
Tumour	...	...	...	...	...	1	—
Unknown	...	...	...	...	...	—	1
Total						11	3

African Officials.—The total number of African Officials on the sick list is about the same proportionately to the average number resident as in the previous year, but there is a distinct improvement in the percentages and average loss of time to each official through sickness. The number of invalidings remains high, but the deaths show a satisfactory reduction.

TABLE III.

HEALTH OF AFRICAN OFFICIALS.

Tables showing Sick, Invalidings and Death-rates of African Officials.

						1929.	1930.	1931.
Total number of officials resident	...	...	...	...	...	969	979	920
Average number resident	...	...	...	...	...	969	970	884
Total number on sick list	...	...	...	...	...	1,050	1,048	959
Total days on sick list	...	...	...	...	...	7,486	9,052	7,863
Average daily number on sick list	...	...	...	...	...	25	24·8	21·54
Percentage of daily sick to average number resident	...	...	...	...	...	2·58	2·55	2·43
Average number of days on sick list to each patient	...	...	...	...	...	7·08	8·63	8·19
Average sick time to each resident	...	...	...	...	...	7·72	9·33	8·5
Total number invalided	...	...	...	...	...	8	12	11
Percentage of invalidings to total resident	...	...	...	...	...	·83	1·22	1·19
Percentage of invalidings to average number resident	...	...	...	...	...	·83	1·23	1·24
Total deaths	...	...	...	...	...	6	12	7
Percentage of deaths to total residents	...	...	...	...	...	·61	·91	·76
Percentage of deaths to average number residents	...	...	...	...	...	·61	·92	·79

Causes of invalidings and Deaths of African Officials.

Causes.						Invalided.	Died.
Chronic Rheumatism	...	...	...	...	...	2	—
Chronic Endocarditis	...	...	...	...	...	—	1
Chronic Nephritis	...	...	...	...	...	—	1
Debility	...	...	...	...	...	—	1
Dysentery	...	...	...	...	...	—	1
Epilepsy	...	...	...	...	...	1	—
Hemiplegia	...	...	...	...	...	1	—
Mental alienation	...	...	...	...	...	1	—
Pulmonary tuberculosis	...	...	...	...	...	3	—
Pyelo Nephritis	...	...	...	...	...	—	1
Senility	...	...	...	...	...	1	1
Septic wound head	...	...	...	...	...	—	1
Urethral Stricture	...	...	...	...	...	1	—
Valvular Disease of the heart	...	...	...	...	...	1	—
Total						11	7

TABLE SHOWING THE COMPARATIVE FIGURES OF THE HEALTH OF AFRICAN OFFICIALS FOR THE LAST TEN YEARS. ∞

Year.	Average Number of Officials.	Number on Sick List.	Number of Days off Duty through Sickness.	Average Sick Time to each Official.	Number Invalided.	Percentage of Invalidings to Average Number.	Total Deaths.	Percentage of Deaths to Average Number.
1922	750	1,071	7,887	10.38	7	0.93	6	0.83
1923	750	879	7,586	10.11	13	1.73	7	0.93
1924	900	1,009	8,920	9.91	18	2.00	5	0.55
1925	997	1,121	8,735	8.76	18	1.80	10	1.00
1926	1,000	950	5,375	5.37	6	0.60	4	0.40
1927	1,000	933	7,919	7.91	20	2.00	4	0.40
1928	1,050	967	6,415	6.10	25	2.38	9	0.85
1929	969	1,057	7,486	7.72	8	0.83	6	0.61
1930	970	1,048	9,052	9.33	12	1.23	8	0.92
1931	884	959	7,863	8.5	11	1.24	7	0.79

TABLE IV.
HEALTH OF AFRICAN TROOPS.

The figures show a decided improvement on the previous year, a total strength of 371 showing 1,279 appearances on the sick report, an average of 3·4 appearances per man, in 1931, as compared with figures of 346, 1,836, and 5·3 respectively in 1930. There still remains a tendency to report sick with trivial complaints, and a comparison with the figures for the Police Force gives food for thought.

Royal West African Frontier Force (Non-European).

Average Strength of Battalion in 1931.	Total Number of Deaths.	Death-rate per 1,000.	Total Number of Men on Sick List.	Sick Rate per 1,000.
371	3	8·08	1,279	3,447

TABLE V.
HEALTH OF AFRICAN POLICE.

The health of the Police continued to be satisfactory, the figures for the year being very similar to those of 1930.

Police.

Total Number of Men.	Total Number of Deaths.	Death-rate per 1,000.	Total Number of Men on Sick List.	Sick Rates per 1,000.
296	1	3·37	325	1,097

TABLE VI.
HEALTH OF PRISONERS AND MENTAL PATIENTS.

A special report on these is found in Section III—"Prisons and Asylum."

TABLE VII.
INSTITUTIONAL TREATMENT.

The subjoined table shows an appreciable reduction in the number of new cases seeking treatment, but an increase in subsequent attendances. The reduction in new cases, of 5,496 is more than accounted for by the large decline in cases of Yaws, 6,633 showing that there was an increase in other diseases treated. A very slight increase in the percentage of deaths to total number treated is recorded, but it is still lower than in previous years.

The following table gives comparisons for the past three years; for this year distinguishing the cases treated in the Colony and Protectorate.

					1929.	1930.	1931.
IN-PATIENTS :							
European	...	...	...	...	147	127	94
African	{	Colony			4,431	4,642	{ 3,318
		Protectorate					1,457
OUT-PATIENTS :							
European	{	Colony			448	511	{ 363
		Protectorate					238
African	{	Colony			97,505	94,975	{ 34,312
		Protectorate					54,977
Total	...	...	...	...	102,531	100,255	94,759
DEATHS :							
European	...	...	...	...	7	5	3
African	{	Colony			368	295	{ 248
		Protectorate					49
Total	...	...	...	...	375	300	300
Percentage of deaths to total number treated					·36	·29	·31
Showing decrease or increase of total number of patients treated					+14,890	−2,276	−5,496
Subsequent attendances					247,438	227,313	239,551

The following table shows the main illnesses for the cure of which patients applied at various hospitals and dispensaries. Figures for 1930 are also given.

Diseases.								1930.	1931.
Malaria	...	...	...	...	...	...	...	6,101	6,624
Yaws	...	...	...	...	...	...	...	14,082	7,449
Acute Rhenmatism	...	...	...	...	...	...	...	815	501
Chronic Rheumatism	...	...	...	...	...	...	...	4,327	5,081
Diseases of the spleen	...	...	...	...	...	...	...	262	436
Hemiplegia	...	...	...	...	...	...	...	164	123
Neuritis	...	...	...	...	...	...	...	178	192
Other affections of the nervous system such as paralysis agitans	...	...	...	...	...	...	...	184	401
Conjunctivitis	...	...	...	...	...	...	...	706	949
Affections of the ear or mastiod sinus	...	...	...	...	...	...	...	912	860
Other Diseases of the heart	...	...	...	...	...	...	...	37	38
Valvular	...	...	...	...	...	...	...	16	23
Mitral	...	...	...	...	...	...	...	151	150
Aortic	...	...	...	...	...	...	...	49	16
Hæmorrhoids	...	...	...	...	...	...	...	113	120
Lymphadenitis or bubo (non-specific)	...	...	...	...	...	...	...	668	486
Coryza	...	...	...	...	...	...	...	1,082	884
Acute Bronchitis	...	...	...	...	...	...	...	5,239	4,183
Chronic Bronchitis	...	...	...	...	...	...	...	3,694	4,213
Asthma	...	...	...	...	...	...	...	106	143
Other affections of the lungs	...	...	...	...	...	...	...	1,058	982
Caries, pyorrhœa, etc.,	...	...	...	...	...	...	...	1,665	4,169
Gastritis	...	...	...	...	...	...	...	348	394
Dyspepsia	...	...	...	...	...	...	...	3,812	3,495
Diarrhœa and Enteritis two years and over	...	...	...	...	...	...	...	925	958
Aukylostomiasis	...	...	...	...	...	...	...	158	84
Cestoda (tænia)	...	...	...	...	...	...	...	264	621
Ascaris	...	...	...	...	...	...	...	3,417	3,376
Diseases due to intestinal parasite unclassified	...	...	...	...	...	...	...	3	1
Hernia	...	...	...	...	...	...	...	612	479
Constipation	...	...	...	...	...	...	...	6,592	9,253
Other affections of the digestive system	...	...	...	...	...	...	...	677	473
Acute Nephritis	...	...	...	...	...	...	...	62	95
Schistosomiasis	...	...	...	...	...	...	...	97	17
Epididymitis	...	...	...	...	...	...	...	47	40
Orchitis	...	...	...	...	...	...	...	362	208
Hydrocele	...	...	...	...	...	...	...	230	205
Ulcer of the Penis	...	...	...	...	...	...	...	208	110
Abscess	...	...	...	...	...	...	...	878	512
Tinea	...	...	...	...	...	...	...	296	383
Scabies	...	...	...	...	...	...	...	1,545	761
Eczema	...	...	...	...	...	...	...	360	428
Osteitis	...	...	...	...	...	...	...	381	330
Arthritis	...	...	...	...	...	...	...	1,190	1,433
Other Diseases of the bones or organs of locomotion	...	...	...	...	...	...	...	2,164	2,195
Wounds (by cutting or stabbing instruments)	...	...	...	...	...	...	...	1,312	1,053
Fracture	...	...	...	...	...	...	...	156	148
Other external injuries	...	...	...	...	...	...	...	6,347	4,397
Ascitis	...	...	...	...	...	...	...	54	78
Oedema	...	...	...	...	...	...	...	186	233
Asthenia	...	...	...	...	...	...	...	655	838

(ii) COMMUNICABLE DISEASES.

Malaria.—Preventive measures are given in detail under Section III.

In Europeans.—There has been a very satisfactory fall in the number of cases treated and as heretofore, seasonal incidence has proved characteristic of the disease. Very few cases occurred during the dry season, cases first appearing at the onset of the intermittent rains of the tornado season, and the majority throughout the persistent rains of June to September. Seventy-one cases were met with this year, compared with 116 in 1930 and 130 in 1929.

Cases treated in hospital account for thirty of the total, leaving forty-one treated in their quarters. Some of the thirty should not be debited to the account of Malaria in the Colony, as they were seamen from ships visiting the port and had presumably acquired their infection elsewhere. One fatal case of blackwater following M.T. infection is recorded.

The following table shows the relative position of malaria as a cause of lost time among Europeans during the last five years, and confirms from another angle the satisfactory figures recorded above.

Year.	Average number Resident.	Total Sick Days.	Total Days spent on Sick-list for Malaria.	Total Days spent on Sick-list for other causes.	Percentage of Malaria Days to Total Days.	Number of Days lost through Malaria for year per 100 Residents.
1927	250	1,816	497	1,319	27·36	198
1928	280	2,024	626	1,398	30·92	223
1929	251	1,935	435	1,500	22·48	173
1930	260	1,785	526	1,259	29·46	202
1931	177	1,463	258	1,205	17·63	145

In Africans.—Malaria figures for 1931 show an appreciable increase over previous years, probably due to the steadily increasing work in Infant Welfare and Schools. Malaria cachexia is markedly increased. The very large proportion shown as “ unclassified ” is to a great extent due to returns from dispensaries, where the dispensers in charge are unable to use a microscope, but is also partly due to the frequency of African cases of clinical malaria in which the parasite cannot be found.

The following table gives the figures for the past three years:—

Disease.						1929.	1930.	1931.
Malaria—Tertain	...	...	...	..	...	145	45	2
Malaria—Quartain	...	...	...	...	...	12	—	24
Aestivo—autumnal	...	...	...	...	...	1,858	1,957	2,235
Unclassified	...	...	...	...	...	3,558	4,082	4,324
Cachexia	...	...	...	...	...	18	11	39
Blackwater	...	...	...	...	...	6	6	4

Blackwater Fever.—Four cases were reported in 1931, one fatal case being a European, two non-fatal in West Indians and one non-fatal in an African.

Trypanosomiasis.—Four cases were reported, all of proved Gambiense infection. Two of these were fatal. One of the cases was an imported one from Liberia.

Smallpox.—Six cases were notified during the year. There was also noted the unusual occurrence of a death from chicken-pox.

Dysentery.—Appreciably fewer cases of this disease are recorded this year, only 1·8 per cent. of the total epidemic—Endemic incidence. The mortality however, remains high, eight out of fifty-nine Africans treated as in-patients, of which seven were non-amœbic, the later stages of which variety are frequently unamenable to treatment.

Tuberculosis.—There were two cases in Europeans. There is an increase among Africans from 152 to 170. The death-rate cannot be given accurately, only those who die in an Institution being recorded. Of those treated as out-patients, the fatal cases generally die in bush villages, and are rarely seen in the later stages. Even those whose recovery seems hopeless will be removed from hospital by relatives, probably to be taken to a medicine-man as a last hope.

Leprosy shows a marked reduction in new cases reporting for treatment, the total number treated during the year being 293 against 531 in 1930. This is no indication of any reduction in the incidence of the disease. There has been less travelling by Medical Officers, and the disappointing results of the treatment has undoubtedly affected the attendance of many sufferers.

Enteric Group.—No case was recorded during the year.

Yaws.—The continued falling off in the numbers of cases treated is remarkable, 16,929 in 1929, 14,082 in 1930, and 7,449 in the year under reference, and calls for some explanation. It is probable that the very large numbers treated in the last three years, and these have been added to by the Mission Hospitals, have reduced the sources of infection sufficiently to make a marked difference in the incidence of the disease. But part of the reduction may be due to the increased use of B.S.P.T. in place of the arsenical preparations, which has been pressed on the grounds of economy, the former costing less than one-twentieth of the latter. Treatment by B.S.P.T. is generally painful, with some preparations more so than others, and this form of treatment is decidedly less popular.

Venereal Diseases.—As before, claims its full share of case incidence and shows little, though promising, decrease in figures. One death in the Hereditary category is reported. Comparative figures for the past five years are shown below, and this year compares favourably with previous years. The large figures for syphilis in the first two years quoted, were undoubtedly due, as remarked in 1929, to the inclusion of a large number of cases of tertiary yaws.

Diseases.				1927.	1928.	1929.	1930.	1931.
Gonorrhoea	...	...	...	2,286	2,564	2,753	2,581	2,366
Syphilis	...	...	...	2,116	1,836	895	605	592

**Beriberi.*—An outbreak of illness which was diagnosed as beriberi, occurred in the Freetown Prison in the second half of the year, and later extended to the Prison at Kenema in the Protectorate, to the Mental Hospital at Kissy, and to a lesser extent to the Royal West African Frontier Force cantonments at Wilberforce. As liberal additions to the diets brought no cessation of the outbreak, it was decided later that the disease was of the nature of the “ epidemic dropsy ” reported from Southern India. The rice supplied to all four institutions came from the same source.

(b) VITAL STATISTICS.

GENERAL POPULATION.

Staff.—The Chief Registrar.

The Deputy Chief Registrar.

Registrars—Colony 17.

Registrars—Protectorate 10.

Deputy Registrars 22.

Districts.—Colony 17.

Protectorate 22.

The appointment of Chief Registrar of Births and Deaths is held by the Assistant Director of Health Service, and that of Deputy Chief Registrar by the Senior Health Officer.

Registrars in the Colony are appointed from Government Dispensers—where dispensaries exist—or from private individuals. In the Protectorate the Registrars are Medical Officers in the Service of Government, and the majority of Deputy Registrars are their dispensers.

In the Colony the registration of births and deaths is compulsory for all persons. In the Protectorate however, it is compulsory only for non-natives—i.e. Europeans, Asiatics, and Colony-born Africans. For the native population registration is optional.

Population.—It is regretted that all figures from the Census taken in April last are not yet available and to a great extent calculations must still be made on the “ Estimated ” population. Freetown however, in spite of the fact that the death rate has exceeded the birth rate for the past ten years, shows a marked increase in population. This increase is due to the immigration of male natives from the Protectorate, in search of work. This too, accounts for the excess of males over females and the comparatively low birth-rate for an African population. The high crude death-rate is coincident with the excess of male over female deaths recorded. There is abundant evidence that many of the immigrants meet with adverse circumstances and are compelled to adopt an extremely low standard of living.

Population of Freetown 26th April, 1921	...	...	...	44,023
Population of Freetown 25th April, 1931	...	...	...	55,359

Births.—In Freetown every precaution has been taken to secure the registration of births during the year. Ninety-five per cent. of the deaths of children under one year were traced in the birth registers, and this figure is probably a fair indication of the percentage of total births which were registered. The birth-rate per 1,000 was 22.73 for Freetown, and for the Colony exclusive of Freetown, 20.40.

Deaths.—All the cemeteries in Freetown are under control and the number of deaths which escape registration is negligible.

The total number of deaths registered in Freetown was 1,380. (Males 772, Females 608) affording a death-rate of 24.84 per 1,000 of the population. The proportion of male to female deaths was 126.9: 100.

Still-births.—Fifty-two still-births were reported in Freetown, thirty-one males and twenty-one females. In other districts six only were registered, three being males, and three females.

*A full report on the history of the outbreak, and investigation into the cause, will be found on page 80 (Appendix H).

The Infantile Mortality.—The rate was high but showed a welcome decrease when compared with former years. In infants from one day to twelve months old there was a total of 365 deaths, giving a death-rate 289 per 1,000 births. Of this total 145 children died between birth and seven days old, giving a percentage of 39·72 of deaths under one month.

Maternal Mortality.—Two hundred and fifty-one women gave birth to 259 children. There were five maternal deaths giving a maternal mortality rate of 19·9 per thousand.

Tables.—The following tables are based on census (1931) figures wherever possible. Where these figures are not available, a note is made.

TABLE A.
Births and Deaths recorded at all Registration Districts in the Colony :—

DISTRICTS.	BIRTHS.			DEATHS.			DEATHS UNDER TWELVE MONTHS.			REMARKS.
	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Totals.	
Freetown ...	558	552	1,110	675	525	1,200	180	141	321	Infant mortality rate :— Freetown including Cline Town, 289.
Cline Town ...	71	82	153	97	83	180	22	22	44	
Bananas Island	5	4	9	4	2	6	2	—	2	
Hamilton ...	9	12	21	19	10	29	1	2	3	
Hastings ...	33	34	67	45	21	66	5	2	7	
Kent ...	14	12	26	15	5	20	3	2	5	
Kissy ...	27	20	47	92	58	150	6	5	11	
Murray Town ...	25	33	58	54	33	67	11	11	22	
Regent ..	19	26	45	23	21	44	5	3	8	
Sherbro Judicial	32	30	62	51	37	88	11	7	18	
Songo Town ...	51	43	94	34	32	66	5	6	11	Colony other than Freetown, 228.
Tassoh Island ...	45	31	76	39	34	73	17	16	33	
Tombo ...	24	20	44	31	14	45	7	5	12	
Waterloo ...	58	56	114	46	36	82	7	3	10	
Wellington ...	30	21	51	22	26	48	5	12	17	
Wilberforce ...	38	43	81	37	34	71	9	12	21	
York ...	23	20	43	28	22	50	6	5	11	
Total ...	1,062	1,039	2,101	1,312	993	2,305	302	254	556	

TABLE B.
Births and Deaths recorded at all Registration Districts in the Protectorate :—

DISTRICTS.	BIRTHS.			DEATHS.			DEATHS UNDER TWELVE MONTHS.		
	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.
Pujehun ...	—	3	3	9	4	13	—	—	—
Sulima ...	2	3	5	5	—	5	—	—	—
Sumbuya ...	1	1	2	1	1	2	—	—	—
Shebar ...	5	4	9	1	2	3	—	—	—
Moyamba ...	6	9	15	—	—	—	—	—	—
Sembahun ...	1	—	1	—	—	—	—	—	—
Boia ...	3	5	8	2	2	4	—	1	1
Mabang ...	5	6	11	14	8	22	4	3	7
Mano (Njala) ...	—	—	—	—	1	1	—	—	—
Bo ...	10	7	17	4	—	4	—	—	—
Kenema ...	13	6	19	4	3	7	1	1	2
Panguma ...	5	8	13	6	2	8	—	—	—
Daru ...	9	7	16	8	10	18	2	—	2
Pendembu ...	76	96	172	70	90	160	16	18	34
Kailahun ...	73	63	136	53	70	123	5	3	8
Kabala ...	1	—	1	10	3	13	1	—	1
Makene ...	14	9	23	1	1	2	—	—	—
Port Loko ...	19	24	43	15	18	33	8	1	9
Batkanu ...	16	12	28	8	5	13	—	1	1
Kambia ...	14	15	29	8	13	21	1	3	4
Kaiyima ...	3	3	6	—	—	—	—	—	—
Total ...	276	281	557	219	233	452	38	31	69

TABLE C.
Causes of Death :

International List Number.	Causes.	FREETOWN (including Cline Town).		COLONY (excluding Freetown).		PROTECTORATE.	
		No.	Percentage.	No.	Percentage.	No.	Percentage.
9 ...	Cough ...	9	0·65	44	4·72	19	4·20
11b2 ...	La Grippe ...	—	—	1	0·10	—	—
13 ...	Dysentery ...	15	1·08	31	3·35	19	4·20
18 ...	Meningitis ..	1	0·07	1	0·10	2	0·44
22 ...	Tetanus ...	19	1·38	4	0·43	4	0·88
23 ...	Phthisis ...	—	—	1	0·10	9	1·99
23 ...	Tuberculosis, all Forms	26	1·88	28	3·02	9	1·99
33 ...	Leprosy ...	—	—	1	0·10	1	0·22
34 ...	Syphilis ...	—	—	2	0·21	9	1·99
35 (2) ...	Gonorrhoea ...	—	—	5	0·54	3	0·66
36a ...	Septic Absorption ...	3	0·21	—	—	1	0·22
36a ...	Septicaemia ...	28	2·02	11	1·18	9	1·99
36c ...	Gas Gangrene ...	1	0·07	—	—	—	—
38 ...	Malaria ...	243	17·60	115	12·21	25	5·53
39 ...	Sleeping Sickness ...	—	—	2	0·21	—	—
42 ...	Ascaris ...	2	0·14	—	—	—	—
44 ...	Blackwater Fever ...	1	0·07	—	—	—	—
44 (5) ...	Mumps ...	—	—	1	0·10	3	0·66
53 ...	Carcinoma ...	1	0·07	—	—	4	0·88
56 ...	Rheumatism ...	24	1·73	44	4·72	5	1·10
59 ...	Diabetes Mellitus ...	2	0·14	3	0·32	1	0·22
61 ...	Beriberi ...	1	0·07	2	0·21	1	0·22
69 (2) ...	Toxaemia ...	1	0·07	—	—	1	0·22
71b (2) ...	Anaemia ...	—	—	5	0·54	—	—
82a ...	Cerebral Haemorrhage	12	0·86	2	0·21	6	1·32
82a (1) ...	Apoplexy ...	4	0·28	2	0·21	1	0·22
82a (2) ...	Cerebro Spinal Con- gestion ...	—	—	1	0·10	—	—
82c (1) ...	Hemiplegia ...	3	0·21	13	1·40	—	—
82c (2) ...	Paralysis ...	5	0·36	19	2·05	6	1·32
86 ...	Infantile Convulsions ...	53	3·84	39	4·21	21	4·64
87b ...	Neuralgia ...	—	—	10	1·08	10	2·21
87e ...	Neurasthenia ...	1	0·07	—	—	—	—
88 ...	Conjunctivitis ...	1	0·07	—	—	—	—
96 ...	Aneurysm ...	—	—	1	0·10	—	—
100 (1) ...	Hæmorrhoids ...	—	—	15	1·62	—	—
105 (2) ...	Laryngitis ...	—	—	1	0·10	—	—
107 ...	Bronchitis ...	210	15·21	13	1·40	34	7·52
109 ...	Pneumonia ...	141	10·21	53	5·72	31	6·85
110 (2) ...	Pleurisy ...	10	0·72	9	0·97	1	0·22
112 ...	Asthma ...	—	—	2	0·21	1	0·22
115 (1) ...	Stomatitis ...	1	0·07	18	1·94	7	1·54
119&120 ...	Entero-colitis ...	—	—	—	—	2	0·44
119&120a ...	Diarrhoea ...	24	1·73	39	4·21	39	8·62
119&120a ...	Dyspepsia ...	—	—	2	0·21	—	—
119&120a (2) ...	Enteritis ...	42	3·04	10	1·08	7	1·54
122a (1) ...	Strangulated Hernia ...	31	2·24	12	1·29	12	2·65
123 (3) ...	Ischio Rectal Abscess ...	—	—	1	0·10	—	—
124a ...	Cirrhosis of Liver ...	1	0·07	—	—	—	—
125 (2) ...	Jaundice ...	—	—	6	0·64	—	—
125 (2) ...	Hepatitis ...	1	0·07	—	—	1	0·22
129 ...	Abscess ...	—	—	13	1·40	2	0·44
129 ...	Peritonitis ...	6	0·43	6	0·64	3	0·66
131 ...	Nephritis ...	24	1·73	27	2·91	14	3·09
132 ...	Uraemia ...	1	0·07	—	—	—	—
132 ...	Uremic Coma ...	1	0·07	—	—	—	—
133a ...	Pyelonephritis ...	2	0·14	—	—	1	0·22
135a ...	Cystitis ...	1	0·07	1	0·10	—	—
135b ...	Retention of Urine ...	2	0·14	3	0·32	1	0·22
136 ...	Stricture (unqualified)...	5	0·36	6	0·64	1	0·22

TABLE C—continued.
Causes of Death—continued.

International List Number.	Causes.	FREETOWN (including Cline Town.)		COLONY (excluding Freetown.)		PROTECTORATE.	
		No.	Percentage.	No.	Percentage.	No.	Percentage.
139	... Menostasis ...	1	0·07	—	—	—	—
139	... Endometritis ...	—	—	1	0·10	—	—
144	... Puerperal Hæmorrhage	—	—	1	0·10	—	—
146	... Puerperal Eclampsia ...	—	—	—	—	1	0·22
151	... Boil ...	—	—	1	0·10	—	—
152	... Cellulitis ...	—	—	2	0·21	—	—
153	... Ulcer ...	—	—	13	1·40	1	0·22
156	... Lumbago ...	—	—	37	4·	8	1·76
156	... Muscular Dystrophy ...	—	—	2	0·21	—	—
158	... Inanition ...	5	0·36	—	—	1	0·22
158	... Congenital Debility ...	5	0·36	—	—	—	—
159	... Premature Birth ...	66	4·78	6	0·64	9	1·99
161	... Atelectasis ...	5	0·36	2	0·21	—	—
161	... Asphyxia Neonatorum	—	—	2	0·21	1	0·22
161	... Tetanus Neonatorum ...	6	0·43	—	—	—	—
162	... Senility ...	98	7·1	50	5·40	25	5·53
163	... Consumption of a corro- sive poison ...	1	0·07	—	—	—	—
195	... Found Drowned ...	—	—	2	0·21	—	—
199	... Syncope ...	2	0·14	8	0·86	1	0·24
95b (2)	... Heart Disease ...	26	1·88	42	4·54	25	5·53
200 (1)	... Cardiac Failure ...	82	5·94	28	3·02	8	1·76
200 (2)	... Asthenia ...	11	0·79	—	—	—	—
200 (2)	... Asphyxia ...	5	0·36	—	—	—	—
200 (2)	... Coma ...	1	0·07	5	0·54	—	—
200 (2)	... General Anasarca ...	5	0·36	—	—	—	—
200 (2)	... Cachexia ...	1	0·07	—	—	—	—
200 (2)	... Marasmus ...	3	0·21	—	—	1	0·24
200 (2)	... Pyrexia ...	—	—	1	0·10	—	—
200 (2)	... Abdominal Disease ...	24	1·73	50	5·40	20	4·42
200 (2)	... Oedema ...	—	—	4	0·43	—	—
200 (2)	... Dropsy ...	—	—	2	0·21	—	—
200 (2)	... Hyperpyrexia ...	—	—	5	0·54	1	0·24
200 (2)	... Debility ...	74	5·36	36	3·89	24	5·30

TABLE D.
Deaths from Principal Causes :

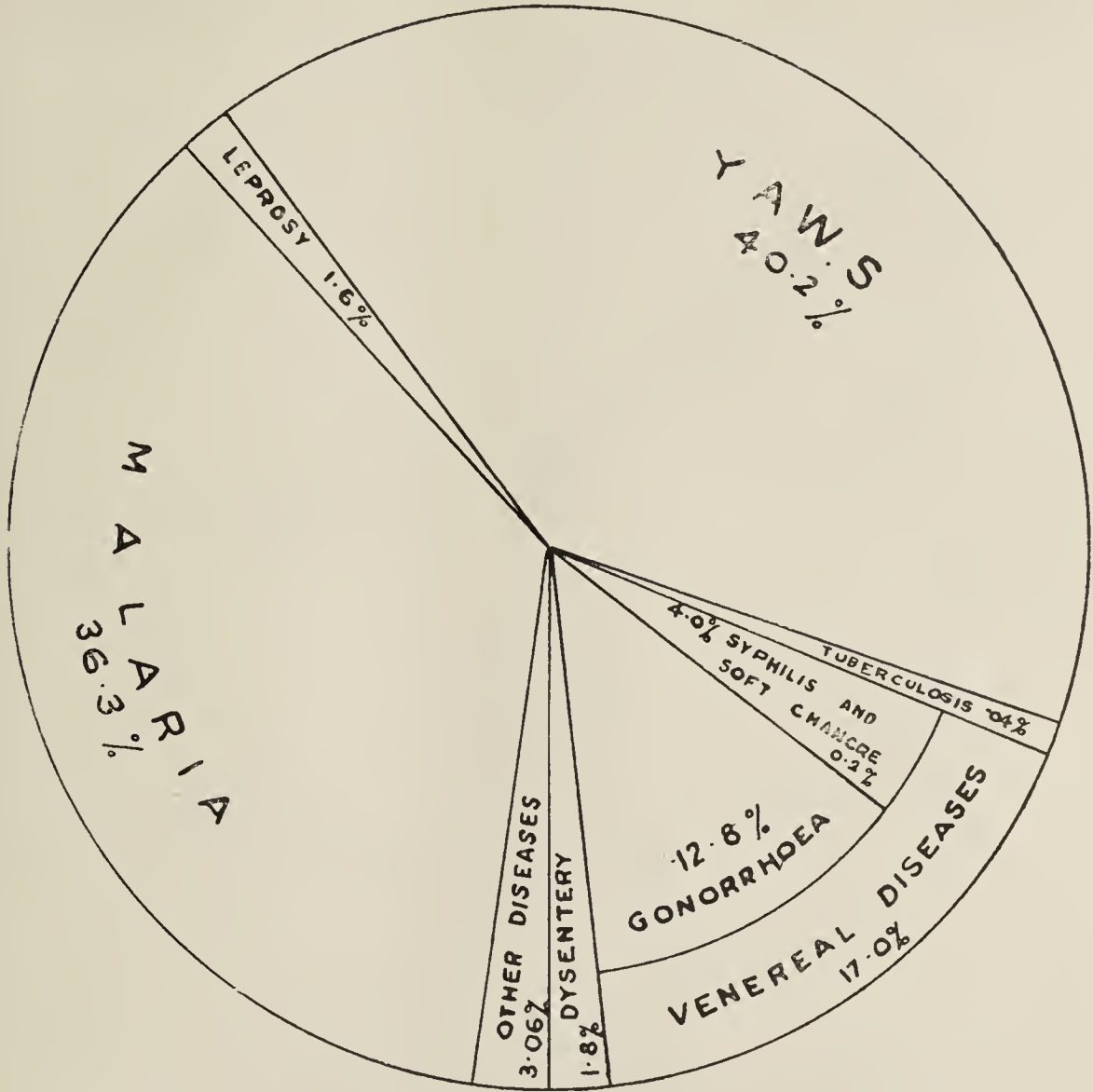
Causes.	COLONY 2,305.		PROTECTORATE 452.	
	No.	Percentage.	No.	Percentage.
Bronchitis and Pneumonia	417	18·09	65	14·38
Malaria	359	15·57	25	5·53
Cardiac Failure and Heart Disease	150	6·50	25	5·53
Senility	148	6·42	25	5·53
Dysentery, Diarrhoea and Enteritis	161	6·98	64	14·38
Debility	110	4·77	24	5·30
Premature Birth	72	3·12	9	1·99
Infantile Convulsions	92	3·99	21	4·64
Strangulated Hernia	43	1·86	12	2·65
Tuberculosis, all Forms	54	2·34	9	1·99
Abdominal Disease	74	3·29	20	4·42
Nephritis	51	2·21	14	3·09
Tetanus	28	1·21	4	0·88
Septicaemia	39	1·69	9	1·99
Rheumatism	68	2·95	5	1·10
Other Causes	439	19·04	105	23·23

TABLE E.

Causes of Death under Twelve months :

International List Number.	Causes.	FREETOWN—365 (including Cline Town).		COLONY—191 (excluding Free- town).		PROTECTORATE 65.	
		No.	Percentage.	No.	Percentage.	No.	Percentage.
9	Whooping Cough	3	0·81	10	5·23	4	6·25
13c	Dysentery	2	0·54	1	0·52	—	—
22	Tetanus Neonatorum	6	1·64	2	1·04	2	3·12
34a	Congenital Syphilis	—	—	—	—	4	6·25
38	Intermittent Fever	1	0·27	—	—	—	—
38	Malaria	9	2·46	4	2·09	3	4·68
57	Congenital Rheumatism	1	0·27	—	—	—	—
69 (2)	Toxæmia (Eclampsia)	1	0·27	—	—	—	—
71	Anæmia	1	0·27	1	0·52	—	—
73 (2)	Splenitis	—	—	2	1·04	1	1·56
86	Infantile Convulsions	53	14·52	48	25·13	12	18·75
87b	Neuralgia	—	—	2	1·04	4	6·25
105 (2)	Catarrhal Laryngitis	1	0·27	—	—	—	—
106a	Acute Bronchitis	2	0·54	4	2·09	—	—
107	Broncho-Pneumonia	17	4·65	3	1·57	7	10·93
107	Bronchitis	38	10·41	4	2·09	1	1·56
108	Lobar Pneumonia	1	0·27	—	—	—	—
110 (2)	Pleurisy	2	0·54	—	—	—	—
114b2	Bulmonary Heamorrhage	1	0·27	—	—	—	—
115 (1)	Stomatitis	1	0·27	—	—	1	1·56
115 (1)	Septic Stomatitis	—	—	—	—	—	—
118 (1)	Gastritis	1	0·27	4	2·09	—	—
119 & 120a2	Dyspepsia	—	—	1	0·52	—	—
119 & 120a2	Flatulent Colic	—	—	1	0·52	—	—
119 & 120a2	Infantile Diarrhœa	8	2·19	4	2·09	3	4·68
119 & 120a2	Enteritis	6	1·64	1	0·52	—	—
123	Impacted Fæces	—	—	—	—	2	3·12
119 & 120a2	Acute Gastro-Enteritis	1	0·27	—	—	—	—
129	Abscess	2	0·54	2	1·04	1	1·56
158	Atrophy	—	—	1	0·52	—	—
158	Congenital Debility	19	5·20	6	3·14	8	12·5
158	Malnutrition	—	—	—	—	2	3·12
158	Asthénia	10	2·73	—	—	—	—
158	Inanition	5	1·36	—	—	—	—
159	Prematurity	53	14·52	10	5·23	6	9·39
160	Delayed Labour	—	—	1	0·52	—	—
161a	Atelectasis (Collapse)	6	1·64	1	0·52	—	—
161a	Asphyxia	—	—	1	0·52	—	—
161b	Icterus Neonatorum	1	0·27	—	—	—	—
161c1	Hæmorrhage from Umbilical Cord	1	0·27	—	—	—	—
189	Destitution of Appetite	9	2·46	—	—	—	—
193	Shock from Thunderstorm	—	—	—	—	1	1·56
200 (1)	Heart Failure	49	13·42	8	4·18	—	—
200 (2)	Fever	49	13·42	49	25·65	3	4·68
200 (2)	Hyperpyrexia	1	0·27	—	—	—	—
200 (2)	Marasmus	2	0·54	1	0·52	—	—
200 (2)	Abdominal Disease	—	—	14	7·32	—	—
—	Pains	—	—	5	2·61	—	—
—	Congenital Absence of the rectum	1	0·27	—	—	—	—
—	Cord wound round twice and very tightly	1	0·27	—	—	—	—

THE PROPORTION OF EPIDEMIC ENDEMIC INFECTIOUS
SYSTEMIC AND OTHER DISEASES SHOWN AS
PERCENTAGES OF TOTAL CASES TREATED.

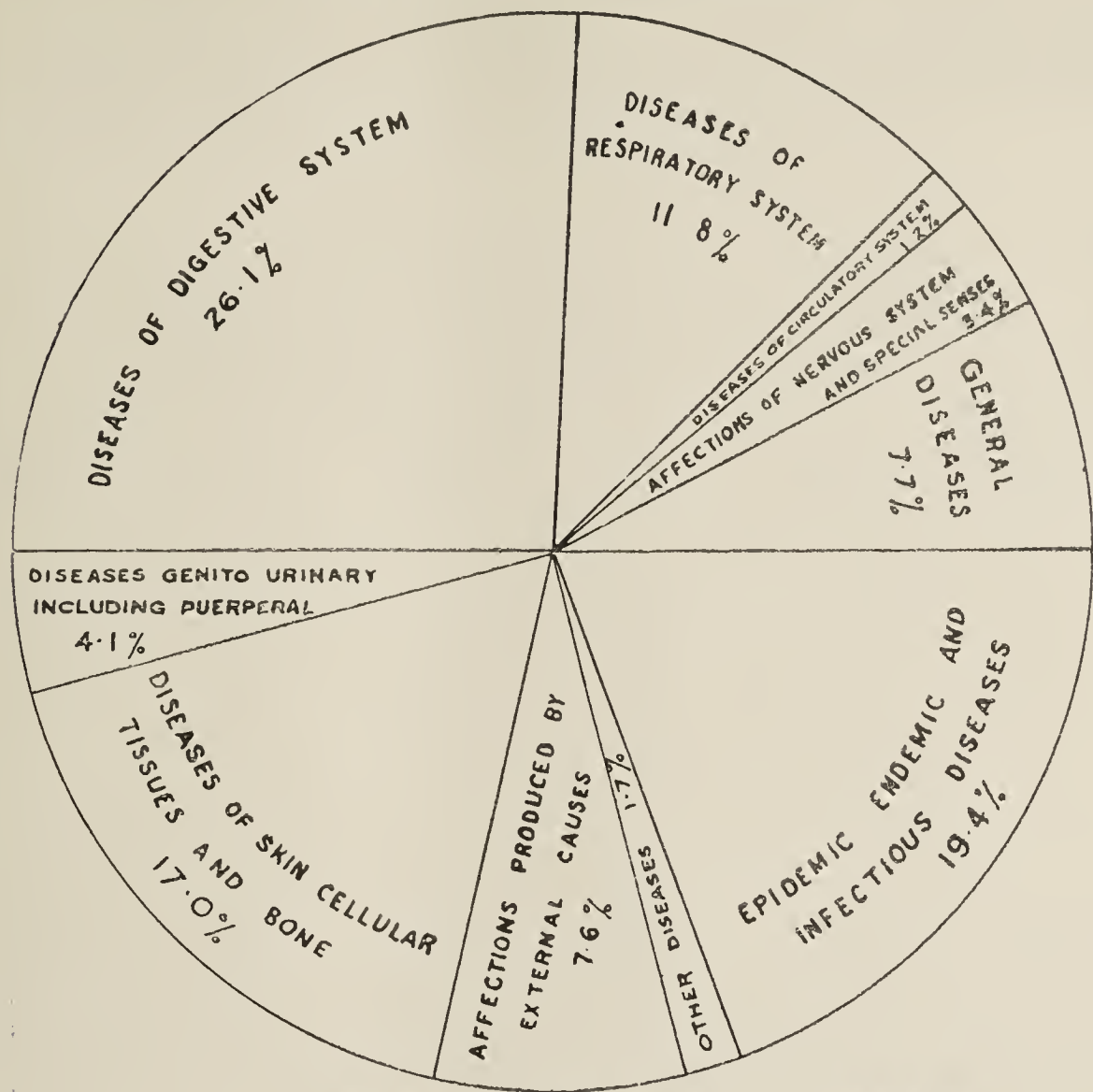


TOTAL INCIDENCE — 18496.

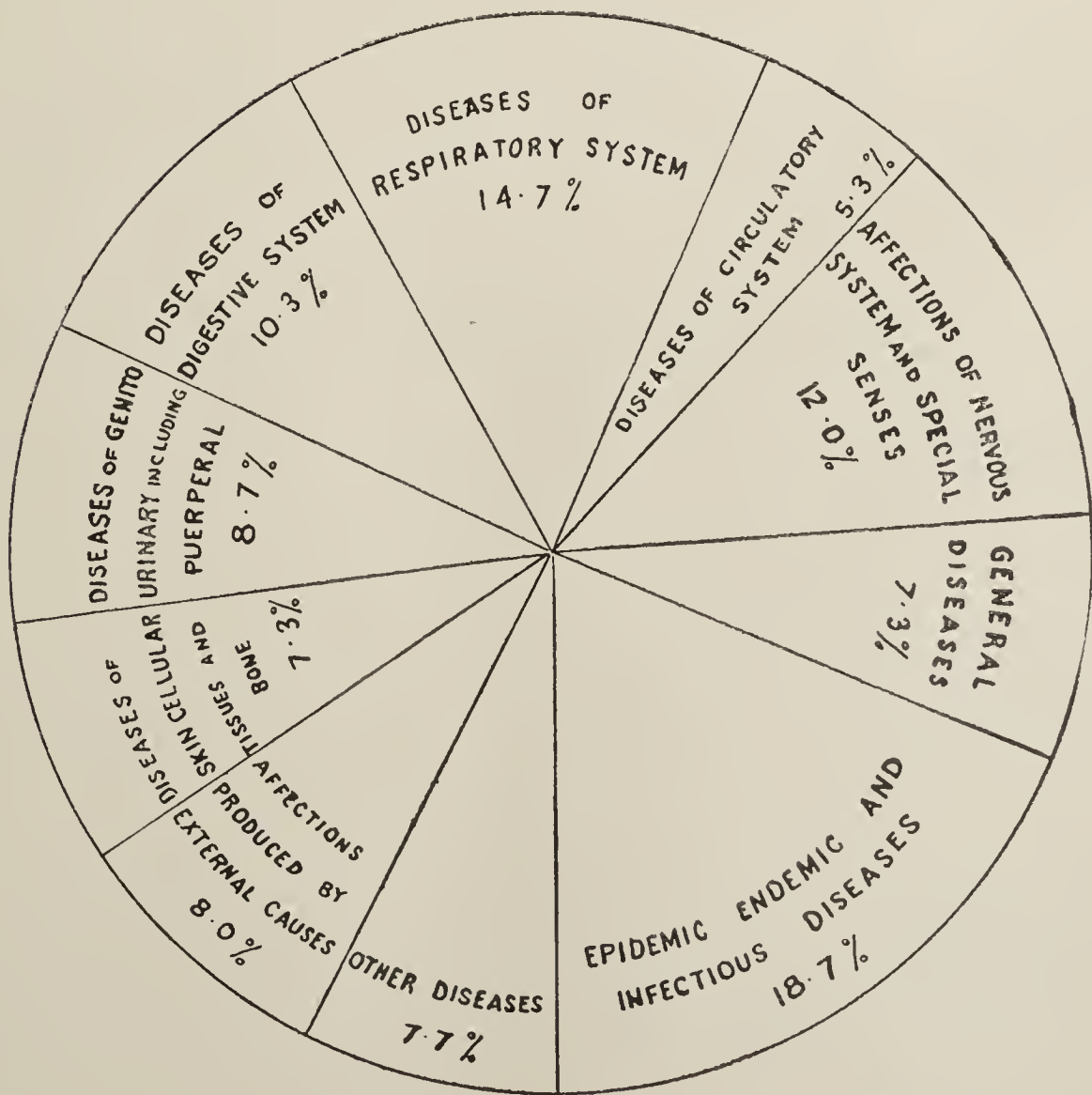


TOTAL DEATHS — 56.

THE PROPORTION OF EPIDEMIC ENDEMIC AND INFECTIOUS DISEASES.



TOTAL INCIDENCE — 94759.



TOTAL DEATHS — 300

Of the 1,380 deaths in Freetown, 290 or 21·01 per cent. were registered on Medical Certificates. In the rest of the Colony, fifty-nine or 6·37 per cent. of the deaths registered were certified. Deaths certified in the Protectorate numbered sixteen. It will be noted that deaths from pulmonary disease and from Malaria account for approximately 36 per cent. of the deaths recorded in Freetown whereas in the Protectorate the intestinal affections rank equally with pulmonary disease as the chief causes of death.

TABLE F.

Deaths at various ages up to twelve months with percentages of total deaths under twelve months, Freetown.

Year.	Under one month.	1—3 months.	Total under three months.	3—6 months.	6—12 months.	Total under twelve months.
1930	200 or 53·9 per cent.	53 or 14·2 per cent.	253 or 68·1 per cent.	53 or 14·2 per cent.	65 or 17·7 per cent.	371
1931	205 or 56·16 per cent.	58 or 15·89 per cent.	263 or 72·05 per cent.	45 or 12·32 per cent.	57 or 15·61 per cent.	365

TABLE G.

Infantile Mortality—Freetown and Colony, 1927—1931.

—		1927.	1928.	1929.	1930.	1931.
Freetown	... ..	351	364	319	336	289
Colony	... ..	217	264	266	249	229

TABLE H.

Maternal Deaths Associated with Pregnancy and Child-bearing, Freetown :—

Causes.	Number of Deaths.			Maternal Mortality rates per 1,000 live births.
	Certified.	Uncertified.	Total.	
Puerperal Fever	1	—	1	Disease of the Puerperal : i.e., Puerperal Sepsis 3·16.
Puerperal Septicaemia	1	—	1	
Sapraemia following child-birth Hyperpyrexia	1	—	1	
Puerperal Septicaemia—Dystocia	1	—	1	
Enteritis (in puerperium) Collapse	1	—	1	Disease complicating Pregnancy 0·79.
Excessive vomitting due to pregnancy	—	1	1	Disease and accident of Pregnancy 0·79.
Total	5	1	6	

The Maternal Mortality was 4·76 per cent. per 1,000 live births.

III—Prisons and Asylum.

KISSY LUNATIC ASYLUM.

Staff.—Medical Officer in charge
First Class Dispenser
Chief attendant
Assistant Chief Attendant
12 Male Attendants
Matron
3 Female Attendants
1 Cook
4 Porters.

The following table gives the statistical details of patients during the year:—

					Males.	Females.	Totals.
Remaining in the Asylum 31st December, 1930	...	...	...	...	59	38	97
Admitted under observation	...	...	...	...	29	27	56
„ certified	...	...	...	...	1	—	1
Certified after observation	...	...	...	...	8	9	17
Died certified	...	...	...	...	30	8	38
Discharged after observation	...	...	...	...	21	19	40
„ as cured	...	...	...	...	1	—	1
„ on trial	...	...	...	...	3	2	5
Re-admitted	...	...	...	...	2	—	2
Absconded	...	...	...	...	1	—	1
Remaining in Asylum 31st December, 1931	...	...	...	...	35	37	72

The total number remaining at the end of the year is the lowest for very many years, and is mainly due to the high death-rate, and to a less extent to a reduction in the numbers certified after observation. The thirty-eight deaths make the highest number recorded since 1920 with forty-four. Of these, fifteen died of a disease at first diagnosed as beriberi, but afterwards in certifying death called “serous pericarditis,” this being the most prominent and constant post-mortem finding. Post-mortem examinations were made in thirty-two of the thirty-eight deaths. The details concerning this outbreak will be found in the general report on page 89.

REPORT ON THE FREETOWN PRISON.

Dr. W. Allan was in charge during the early part of the year, he was relieved by Dr. Jennings on the 24th February; Dispenser M. P. Neville relieved Dispenser Robbin Coker on the 30th June.

HEALTH OF PRISON OFFICERS.

Europeans.—This was very good. One was placed on the sick list for seven days from Bronchitis.

Africans.—Good; this includes Government employés—forty were treated; of these eight were sent to the Connaught Hospital for further treatment, and one was sent to the Infectious Diseases Hospital, Kissy, for Varicella. Nineteen on the whole were on the sick list as against thirty-one in 1930.

HEALTH OF PRISONERS.

The health of prisoners on the whole was good. During the latter half of the year there was an outbreak of disease with symptoms indistinguishable from beriberi. Two cases were placed under observation in June, the diagnosis of beriberi being confirmed in one in consultation with another Medical Officer (Dr. Wright).

Since then there have been nineteen cases admitted to Prison Hospital, and one death, the first case admitted. In this case the diagnosis was confirmed by Dr. Renner in post-mortem examination, the immediate cause of death being Pericardial effusion. The early symptoms of the condition were Dyspepsia (Epigastric pain) Pretibial Oedema, Constipation and Tachycardia.

In July, the yeast allowance per man was increased, and in August, one prison block (B) was placed on a diet which substituted potatoes for part of the rice ration, and reduced the issue of ground-nuts on three days weekly. All convalescent cases from hospital and all suspected cases were placed in B. block which also housed an average number of ordinary prisoners (about 50).

No new cases occurred in B. block, but two cases relapsed, one of them being actually the second suspected case in the outbreak.

As reported in August, 1931, the disease occurred mostly amongst men over forty, with sedentary occupations, and showing a steady increase in weight. The cases in hospital received an issue of Bemax and Marmite daily, and rice ration was replaced by bread. The only medicinal treatment was Salol grain twenty daily, and Calcium Lactate grain ten daily. During the year several cases of A. and B. deficiency disease (described by Dr. Wright, 1930) were received into Prison. They recovered rapidly on the ordinary prison diet, which contains added yeast and cod liver oil.

GENERAL HEALTH.

There were 788 new cases and 6,263 subsequent attendances treated as out-patients and 179 cases in-patients. The prevalent diseases were Malaria, Gonorrhœa, Beriberi, Bronchitis, Dyspepsia, Constipation, Ulcer and External injuries. Beside the above cases treated there was Medical Inspection parade every Wednesday afternoon when Mist. Quinine, Mist. Alba, Cough mixture, Liniment and Sulphur were issued to every prisoner as required.

Four deaths occurred during the year; the causes were Pneumonia, two; Mitral Regurgitation and Cirrhosis of liver, one; beriberi, one.

There were 417 specimens of stools sent to the laboratory for examination with the following results :—

Ankylostome ova	...	...	129	Ascaris ova	...	...	59
Strongyloides larvæ	...	...	51	Taenia ova	...	...	13
Trichina ova	...	...	20	Other parasites	...	...	4
E. Ccli Cysts	...	...	4	No parasites	...	...	133

Two condemned prisoners were executed during the year.

One convict and one remand prisoners were sent under emergency certificate to the Lunatic Asylum; the former was detained.

The daily average sick in hospital was 9.1.

The daily average strength of prisoners, 236.9.

The weight of prisoners ranged from 84 lbs. to 196 lbs.

A monthly record is kept of the weight of every prisoner sentenced to six months or more and notice taken of any marked increase or loss of weight.

The total number of prisoners vaccinated during the year was 206; successful, 177.

The sanitary condition of the Prison remained good throughout the year.

Quinine issued to officials for Prophylactic purposes :—

Europeans	...	...	...	...	1,625 grains.
Africans	...	...	...	...	800 grains.

STATISTICAL RETURN.

In hospital at end of December, 1930	...	...	...	...	4
Admitted during the year 1931	...	...	...	...	179
Remaining in hospital at end of December, 1931	...	...	...	...	11

	March Quarter.	June Quarter.	September Quarter.	December Quarter.	Total.
Admitted	28	54	42	55	179
Cured	19	40	23	36	118
Improved or relieved	4	6	17	17	44
Not relieved	1	1	nil	1	3
Died	2	1	1	nil	4
Observed only	2	5	2	1	10

Daily average number of prisoners ... 236.9

	New Comers.	Remand and Trial.	Corporal Punishment.	Execution.
March quarter	309	36	nil	1
June quarter	188	28	5	1
September quarter	186	31	nil	nil
December quarter	216	33	nil	nil
Total	899	128	5	2

Out-Patient.

			New Cases.	Subsequent Attendances.
March quarter	...	...	208	1,910
June quarter	...	...	185	1,525
September quarter	...	...	191	1,456
December quarter	...	...	212	1,374
Total			796	6,265

Freetown Prison.				1929.	1930.	1931.
Total number of prisoners admitted	...	...	...	851	902	913
Average strength	...	...	...	243	263	239
Total deaths	...	...	...	19	3	4
Total number of prisoners on sick list	...	...	...	246	186	179
Daily average number on sick list	...	...	...	6.17	6.8	9.1
Daily sick-rate per 1,000 of average strength	...	...	...	25.39	25.85	38.07
Death-rate per 1,000 of average strength	...	...	...	78.19	11.40	16.73

Prison.				Daily Average Number in Custody in 1931.	Daily Sick-rate per 1,000 of Average Strength.	Death-rate per 1,000 of Average Strength.
Freetown	...	...	...	239	38.07	16.73
Pujehun	...	...	...	24	8.54	—
Batkanu	...	...	...	36	28.33	27.77
Kenema	...	...	...	52	29.65	115.38
Moyamba	...	...	...	31	4.83	—

C. B. JENNINGS,
Medical Officer.

IV—Hygiene and Sanitation.

A—GENERAL REVIEW OF WORK DONE AND PROGRESS MADE.

I—PREVENTIVE MEASURES.

(a) Insect-borne Diseases.

Malaria.—During the period under review the staff of the Sir Alfred Jones Laboratory carried on a Malaria survey, the commencement of which was outlined in the Report for 1930. A summary of the results of their investigations is attached as Appendix C.

Naturally, their own report will show in greater detail the facts elicited by their research. It will suffice here to observe that their statistics are on a parallel with those of Macdonald in 1926 as regards the infectivity rate in children. During the past few years an apparent change in the type of infection appears to have taken place. As before outlined, infection in the Western district of Freetown i.e. in that area containing Sanders Brook was heavier than the other districts of Freetown. Under the Colonial Development Fund scheme this brook has been canalized and the surrounding ground filled and levelled, and tributary drains graded, concreted and linked in. The improvement effected by these measures is brought out in the report of the Sir Alfred Jones Laboratory herewith attached as Appendix C; and notwithstanding the intermittency of the early rains, affording as they did, ideal conditions for mosquito breeding, it is gratifying to record a decrease in the number of cases recorded as compared with former years, even though the Lady Medical Officer, by her incessant school inspection came more closely into contact with those age groups of the population i.e. the children—who are normally the most heavily infected would normally have put up the figures had the infectivity rate maintained the figure of former years.

The figures of 6,520 for 1931 as compared with 6,101 for 1930 being as they are for Freetown, the Colony and Protectorate, do not truly represent the conditions existing in Freetown.

The financial stridency caused by the world-wide economic depression rendered necessary the abolition of the appointment of the Lady Medical Officer on the 17th June, 1931. The same shortage of money greatly impedes the scheme of the replacement of thatched roofs by galvanised iron.

Preventive measures normally directed against all insect-borne disease have been prosecuted in 1931 with the same zeal as in former years. The report of the Medical Officer of Health gives details of the routine work carried on in Freetown.

EXTRACT FROM THE REPORT OF THE MEDICAL OFFICER OF HEALTH.

(a) *Inspection of Compounds—Mosquito Larvae.*—131,277 compounds were inspected as against 144,897 in 1930. Mosquito larvæ were found in 574 and the occupiers prosecuted. 549 were convicted and fines totalled one hundred and nine pounds six shillings were imposed.

The larvæ were as follows:—

Stegomyia	...	...	...	...	...	...	360
Culex	...	...	...	...	...	...	210
Anopheles	...	...	...	...	...	...	4

The fact that 13,620 less compounds were inspected and 123 more samples of larvæ found, points rather to greater efficiency on the part of the inspectors than to any great increase in the number of mosquitoes.

(b) *Oiling.*—166,617 pools were oiled and 8,718 gutters—a considerable increase from 1930, but due to the increased rainfall. Oiling is done mainly in the rainy season, a very small amount being done in the dry season. The oil used was a mixture of Soldis fluid, kerosene and castor oil, and is not only efficacious but cheaper than most mixtures.

(c) *Inspection of Boats and Canoes.*—11,266 boats and canoes were inspected. Three samples of larvæ were found.—Culex 2; Stegomyia 1.

(d) *Inspection of Trees.*—7,929 trees were inspected. 2,882 holes were chipped and 4,540 were cemented. 142 tree holes contained larvæ:—

Stegomyia	...	...	...	...	...	...	97
Culex	...	...	...	...	...	...	45

(e) *Canalization.*—Alligator's, Nicol's, Moore's and Granville's brooks were canalized at the end of the rainy season as usual. Sanders Brook has been permanently canalized throughout two-thirds of the length of its course, and little temporary work is now required there. Whenever the heavy rains commence these temporary channels are swept aside with the result that this work must be continued year after year. There is no doubt about the importance of the work; in fact, it is one of the main factors in reducing the mosquito prevalence, but when funds permit, the ideal would be permanently to canalize the remaining four brooks in Freetown.

Filariasis.—A series of tests carried out by the staff of the Sir Alfred Jones Laboratory at several institutions in Freetown demonstrates the improbability of Freetown being an endemic focus of this disease and whilst their figures show a remarkable constancy for those institutions which harbour the Protectorate native, e.g. the Prison, it is noteworthy that the institutions which cater more especially for the Colony born show no great increase of this disease.

Date.	Place.	Number Examined.	Sex.	Species.	Number showing Filaria.	Percentage.
April, 1930	...	Prison	134	Male	Bancrofti 26 Perstans 3	19·03 2·24
September, 1930	...	Connaught Hospital	80	Male and Female	Bancrofti 7 Perstans 1	8·75 1·25
March, 1931	...	Prison	97	Male	Bancrofti 20 Perstans 1	20·64 1·02
May, 1931	...	Albert Academy	48	Male	Bancrofti } Perstans } Bancrofti 8	1·02 16·67

Trypanosomiasis.—Notwithstanding the cessation of anti-tsetse work carried on at the Cape, no case of trypanosomiasis was reported in Freetown.

Yellow Fever.—In so far as can be gauged by the ordinary routine work of Government Medical Officers in the Colony and Protectorate this disease would appear to be remarkable by its absence from Sierra Leone and in that respect must be almost unique in the West African Continent. No cases were reported during the year, but consequent on the finding of a Yellow Fever immune child in 1930, further blood samples have been taken from various age groups and forwarded to the Rockefeller Foundation, but the report on these is not yet to hand.

(b) *Epidemic Diseases.*

Plague.—No cases were notified during the year, and the routine examination, both macroscopic and microscopic of 2,600 rats during the year failed to demonstrate *B. Pestis*.

It is proposed to cease the somewhat expensive system of paying for rats caught by private individuals. Rat inspectors and de-ratting gangs will however be retained as in former years, and in view of the continued existence of sporadic outbreaks of plague in countries adjacent to this Colony, strict measures of inspection and disinfection of deck passengers and Kroo labourers will still be carried out. As outlined in previous reports, the Washington-Lyons high pressure disinfector deals in a capable manner with the question and during the year under review 18,638 people and their effects were dealt with.

Small-pox.—Six cases were reported during the year. The following table gives the number of vaccinations performed in Sierra Leone. The supply of Lymph was adequate and of good quality.

Place.				Total Number Vaccinated.	Successful.	Unsuccessful.	Not Seen.
Freetown	...	...	...	2,039	1,129	569	339
Batkanu	...	...	...	259	197	27	35
Makeni	...	...	...	948	522	233	193
Port Loko	...	...	...	126	84	22	20
Bauya	...	...	...	92	84	7	1
Bo	...	...	...	286	264	17	5
Daru	...	...	...	—	—	—	—
Pendembu	...	...	...	169	73	—	96
Kambia	...	...	...	80	45	17	18
York	...	...	...	48	44	3	1
Kabala	...	...	...	54	19	5	30
Sembehun	...	...	...	77	68	6	3
Regent	...	...	...	7	7	—	—
Moyamba	...	...	...	221	119	66	36
Waterloo	...	...	...	400	400	—	—
Sumbuya	...	...	...	878	665	106	107
Kaiyima	...	...	...	503	335	9	159
Pujehun	...	...	...	780	372	205	203
Mano	...	...	...	290	285	3	2
Bonthe	...	...	...	502	293	109	100
Kailahun	...	...	...	292	168	66	58
Kent	..	...	...	178	113	54	11
Kenema	...	...	...	162	156	4	2
Mabang	...	...	...	—	—	—	—
Grand Total				8,391	5,442	1,528	1,419

Diphtheria.—During the year one case was reported and diagnosed. The presence of a superadded infection and the absence of adequate laboratory facilities rendered impossible the isolation of the *K. L. Bacillus* in pure culture. Swabs taken from the throats of contacts proved negative. The usual preventive measures were taken and no further cases occurred.

Dysentery.—Three hundred and thirty-four cases were reported during the year. Of these, Freetown reported 105 with 8 deaths, the Colony and Protectorate claiming the remainder. Four of the cases occurred in Europeans. It is to be hoped that the gradual extension of health areas in the Protectorate, with the resultant greater care of night-soil disposal will in time serve to reduce the incidence of this disease, which in this year has yielded 100 per cent. more cases than have occurred in Freetown.

In 1930, only 261 cases were notified, of which 47 occurred in Freetown, but it should be noted that Dysentery was made compulsorily notifiable only in January, 1931.

Enteric Group.—No case of typhoid was reported during the year, though it is difficult to believe that this represents a true state of affairs with reference to typhoid. It should be noted that in the Protectorate the absence of laboratory facilities renders extremely

difficult the diagnosis of, at any rate, para-typhoid cases, which must often be treated under the generic title Enteritis. The gradual opening up of health areas in the Protectorate and the improved sanitary conditions appertaining therein, and a more careful inspection of food supplies combined with the improved methods of refuse and night-soil disposal must inevitably tend to the reduction of this disease, which has never reached epidemic proportions in Sierra Leone.

Tuberculosis.—This disease was made compulsorily notifiable only in January, 1931, and this in some measure is responsible for the increase in the period under review; in 1930, only 90 cases were notified of which 30 were in Freetown; in 1931, the figures are 172 and 82 respectively, there were 14 deaths during the year, of which five were in Freetown. It is not seriously contended that these figures accurately show the incidence of this disease, and, in the absence of sufficient funds for the improvement of housing with the consequent relief in house and population density, the activities of this Department are restricted to the thorough disinfection of all houses where cases are notified; and the general dissemination of Public Health knowledge.

Pneumonia—As was to be expected from the heavy rainfall of 1931, pneumonia shows an increase over last year, 194 cases with 25 deaths being recorded in 1931, compared with 123 cases in 1930. In 1931, Freetown accounted for 108 cases with 20 deaths, probably due to the influx of Protectorate Natives who through poor economic conditions are compelled to live on but meagre earnings, and are thus in a low state of health to fight this infection.

Leprosy.—Two hundred and ninety-three cases were notified as against 460 in 1930. It has been found impossible to set up any general scheme of Leper Asylums, owing to financial stringency, but during the year a new house capable of accommodating 40 people was erected at Kissy. The majority of lepers come down from the Protectorate.

Yaws.—Seven thousand four hundred and forty-nine cases reported in 1931, compared with 14,082 in 1930, being good testimony of the success of the treatment which has been carried out so vigorously.

(c) *Helminthic Diseases.*

Ankylostomiasis.—Only 84 cases were reported in 1931, compared with 158 in 1930. The disease is not commonly prevalent in Freetown, only 11 cases being reported. It is hoped that the Sanitary measures laid down for mining areas in the Protectorate will be effective in preventing any increase of this disease in those areas where large numbers of labourers are brought together.

Ascariasis.—This widespread disease remains fairly constant and must do so until the inhabitants of the Colony and especially of the Protectorate are imbued with a higher Sanitary concept. 3,376 cases were reported in 1931, compared with 3,417 in 1930. It is worthy of note that only 483 of these occurred in Freetown.

Schistosomiasis.—During the year only one case was notified in Freetown, while 16 were reported from the Protectorate showing quite a decrease from the figure of 97 for 1930.

No detailed survey was done during the year.

Disease.	FREETOWN.				REMAINDER.			
	European.		African.		European.		African.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Trypanosomiasis ...	—	—	4	1	—	—	1	1
Yellow Fever ...	—	—	—	—	—	—	—	—
Plague ...	—	—	—	—	—	—	—	—
Smallpox ...	—	—	—	—	—	—	6	—
Diphtheria ...	1	—	2	1	—	—	—	—
Dysentery ...	3	—	102	8	1	—	228	—
Enteric Group ...	—	—	—	—	—	—	—	9
Tuberculosis ...	2	—	80	5	—	—	90	5
Pneumonia ...	—	—	108	20	—	—	86	3
Leprosy ...	—	—	22	—	—	—	271	2
Yaws ...	—	—	486	—	—	—	6,963	—
Ankylostomiasis ...	—	—	11	—	—	—	73	—
Ascaris ...	1	—	482	—	1	—	2,892	—
Schistosomiasis ...	—	—	1	—	—	—	16	—
Cerebro Meningitis ...	—	—	1	1	—	—	—	—

(d) *Animal Diseases.*

No outbreak of epizootic disease was notified in any district. Routine inspection of carcasses after slaughter by Health Department at Freetown revealed the following conditions:—

Disease.	Number Slaughtered.	Number Infected.	Percentage.
Anthrax	2,818	2	·07
C. Bovis		2	·07
Angioma		2	·07
Liver Abscess		20	·7
D. Hepaticum		6	·21

Cattle.

Sheep and goats slaughtered numbered 473. No infections were found. The slaughtering of animals for the purpose of sale is prohibited in all but appointed places throughout the health areas of the Colony and Protectorate, a fact which should assist in the early detection of epidemics.

The Dogs Ordinance, which provides for the licensing of dogs and the destruction of ownerless dogs is in force in Freetown and in the Sherbro Judicial Districts and was this year applied to Hill Station. A request was also received from the District Commissioner, Bo, for its application to that town. An Amendment to the Ordinance to provide for its application to health areas in the Protectorate is under consideration.

During the year, 891 dogs were licensed and 3,140 unlicensed dogs were destroyed as the result of a series of round ups which were made by the Police. These periodic inspections are to a great extent responsible for the elimination of diseased dogs in places where the Ordinance is in force. Rats caught during the year in Freetown numbered 42,000. Fortnightly examination made by the Government Pathologist for plague infection were all negative. (2,049 rats were examined). No cases of psittacosis were reported in man or in birds although the keeping of parrots is a familiar hobby in the Colony.

II—GENERAL MEASURES OF SANITATION.

Sewage Disposal.—The system in operation remains exactly the same as that in use in 1930 i.e., most private houses possess cesspits, and Freetown possesses fifteen public latrines of the pan type. Cesspits are disinfected when it considered necessary, and oiled when watery. The pans of the public latrines are emptied into the sea and washed on the foreshore. Neither method can be considered satisfactory in such a town as Freetown. Any alternative scheme no matter how desirable it may be would be extremely costly, and with the present financial depression and its probable continuance for some time yet to come, the system at present in vogue must remain. In the Protectorate and those parts of the Colony outside Freetown, the Salda type of latrine is almost universal for the use of the indigenous population, and those in all health areas or towns possessing dispensers or sanitary inspectors receive the same treatment as do those in Freetown. Great care is taken to site these Saldas, when public, at an adequate distance from any water-supply. The juxta position of wells to private compounds is prohibited. All European Bungalows in Freetown, the Colony and Protectorate are serviced by the pan system. In the absence of superior methods of nightsoil disposal hook-worm disease must remain an ever present menace to the health of the people.

Refuse Collection and Disposal.—The new alternative scheme of this service was fully outlined in the report of 1930, and has now been in operation three-and-a-half months. It has proved satisfactory from the Sanitary point of view and bids fair to effect those economies which were estimated at its inauguration. The system is sound, but for its continued efficient working an extension of the loading and unloading sites and also an improvement in the design of the railway trucks will become increasingly necessary as the volume of material to remove becomes annually more.

During the year, 13,248 lorry loads, approximately 10,000 tons of refuse were collected from Freetown. In a full working year it is hoped to show a considerable reduction in the cost per ton of refuse so handled. In the Colony villages, Protectorate towns and health areas refuse disposal is achieved by incineration and burying, except in those sea-board towns where disposal can be more cheaply and efficiently carried out by dejection into the sea.

Drainage and other Sanitary Improvements.—In addition to the facilities provided by the Medical Service for the treatment and prevention of diseases, comprehensive measures are provided by Ordinance for the maintenance and improvement of sanitary conditions generally throughout the Colony and Protectorate. The preventive measures in operation resolve themselves chiefly into measures directed towards the provision and maintenance of pure water supplies, and the control of insect borne and other infectious diseases.

Owing to the prevailing financial depression, the engineering side of expenditure on Public Health was mainly restricted to the repair or renewal of permanent structures essential to the preservation of existing water supplies, and of sanitary structures in general. In Freetown, the permanent canalisation of Sanders Brook and the subsidiary drains of several adjoining streets have been completed; concrete or laterite surface drains were provided for seven other streets. The drains at Water Street station were relaid with glazed earthenware. Semi-permanent drainage was provided for the north and south sides of Victoria Park and at portions of Goderich Street and Circular Road. The protection of Moore's Brook outfall and Garrison Street outfall drain have been responsible for a great reduction in mosquito breeding. The construction of surface drains at King Tom Barracks was completed, and the repair of concrete drains and re-grading of earth drains generally was continued.

Four new concrete rat-proof type dustbins were erected in various parts of the city. This is in prosecution of a scheme for replacement by rat-proof dustbins of old open-type bins in a system of eighty dustbins from which refuse is collected by lorries and removed by train to a dumping site nine miles from Freetown.

Daily house to house and general inspections are made for nuisances. Meat and animals for slaughter are inspected daily. A series of inspections of provision stores in the Colony and Protectorate resulted in the seizure of large quantities of unsound foodstuffs of every description. One hundred and sixty-six inspections of schools were made, and in almost every instance it was necessary to draw attention to the serious need for hygienic improvements. The vaccination of school-children was continued.

The Headmen Ordinance contains provisions for the sanitation of the Colony towns and villages. Inspection of the mountain villages was carried out fortnightly by the Police and reports made to the Health Department for necessary action. Other villages in the Colony were visited regularly by sanitary inspectors or by dispensers of the Medical Department.

From the administration point of view, considerable progress was made during the year in the Protectorate. In one enactment under the Protectorate Health Areas Order in Council thirty-three of the more important towns and villages were declared Health Areas and the Public Health (Protectorate) Rules applied to all of them. The rules make provision for, *inter alia*, town planning and building regulations, protection of water supplies, drainage, disposal of refuse and night-soil, clearing of bush, management of markets and slaughter houses, food inspection and the notification and control of epidemic diseases in man and animals. Sanitary Inspectors are stationed at ten of the larger centres, their duties including periodic visits to the neighbouring health areas for the purpose of making inspections and advising the paramount chiefs who are health authorities where no special health authority exists. In fourteen of the health areas the Ordinance is administered by a special health authority consisting of the District Commissioner, the Medical Officer, the Paramount Chief and one other member. Monthly Sanitary Reports are returned on a form of questionnaire based on the Health Rules.

As funds permitted, Government has provided pipe-borne water supplies, or protection of the natural source; markets, slaughter houses, incinerators. This has been more especially applied where the chiefs and natives have shown a keenness for and appreciation of sanitation and have endeavoured to make progress by their own efforts. It is encouraging to note that this keenness and voluntary effort is becoming more widespread throughout the Protectorate.

III—WATER SUPPLIES.

There was no money available for the extension of water supplies. Expenditure was restricted entirely to improvements of and repairs necessary for the maintenance of existing supplies. The Engineer of the Freetown Water-works reports as follows:—

Every section of the works was kept up at the usual standard of efficiency.

Consumption.—The total consumption for all purposes during the year was 171,214,000 gallons as against 161,036,000 gallons the previous year; i.e., an average of 469,000 gallons per diem. The supplies to shipping and for trade and other non-domestic purposes were 3,235,000 and 5,511,000 gallons respectively as compared with 3,942,000 and 4,882,000 gallons for the previous year. The supply for purely domestic purposes was 162,468,000 gallons, an average of 445,000 gallons per diem as against 152,212,000 gallons for the previous year. The maximum daily consumption was 629,000 gallons on the 15th of March and the minimum, 203,000 gallons, on the 27th of April during the period the city was on a restricted supply.

Private Services.—Seventeen new services were laid during the year. There were at the close of the year 456 private services with 962 taps. The number of Government water services remain at eighty-four.

Public Standposts.—No new public standposts were erected during the year.

Distributing Mains.—323 yards of 4 inches cast iron main with three hydrants were laid along West Street. This has improved the supply to that portion of the town. 224 yards of 4 inches cast iron main with one hydrant were laid at Liverpool Street between Pademba Road and Westmoreland Street. This has improved the circulation in that quarter.

Shortage of Water.—The shortage of water this year lasted from the 13th of April to the 3rd of May. During this period the city was placed under restricted supply.

Pumping.—The pumping unit at the Lumley Valley was in operation from the 4th of March to the 5th of May.

Protection and Preservation from Lumley Valley.—1,550 yards of the 8½ inches steel supply main from the Lumley Valley, from Congo Town Wharf to the junction of Westmoreland and Upper Waterloo Streets, were treated during the year. The main was unearthed, scraped and treated with two coats of Bitumastic Solution followed by a coat of Bitumastic Enamel. This should add many years to its life.

IV—SCHOOL HYGIENE.

As reported under the heading “Malaria” the School Medical Officer was retrenched during the year; detailed figures for the Medical inspection of school children are thus not to hand for the year under review.

The Education Ordinance, 1929 and the Education (Protectorate) Rules, 1930, made provision for the inclusion of Hygiene and Sanitation as compulsory subjects to be taught in the schools of the Colony and Protectorate. Provision was also made for the grants to assisted schools to be conditional upon the school buildings reaching a satisfactory standard as regards construction, space accommodation and sanitation of surroundings; thus to ensure the practice as well as the teaching of hygiene in the schools.

The School Medical Officer having been retrenched early in the year, the inspection of schools was carried out as far as possible by the Medical Officer of Health and the Medical Officers in the Protectorate stations. One hundred and sixty-six inspections were made and in almost all instances it was necessary to call attention to the dire need for sanitary improvements. Although little progress can be recorded under this heading during the year it is but part of a general retardation in progressive education due to lack of funds. The Medical Officer of Health reports as follows:—

Freetown.—Three inspections of all schools in Freetown were made with the results shown below. Little pressure can be brought to bear on the Managers of Amalgamated schools as (a) there is no penalty clause in the Ordinance and (b) threats to close the schools would be followed by applications for grants which cannot under present financial conditions, be entertained.

Schools Inspected.

(a) Public (i.e., Government or Government assisted)	35	} 42.
(b) Private	7	

(a) of this thirty-five, five with an average attendance of 107 pupils had at the end of the year no latrine accommodation whatever. One of these schools has since erected a modern type latrine. Twelve have cesspits with insufficient accommodation for pupils and staff. Ten have old type bucket latrines in various stages of repair, and seven have new type bucket latrines. One school is fitted with water-flush system and a septic tank.

(b) of the private schools three have inadequate cesspit accommodation and two have no accommodation whatever. The latrine accommodation in schools in Freetown works out at approximately 3 per cent.

The following table expresses briefly the state existing at the end of the year in the Colony schools.

School.	PERCENTAGE INSPECTIONS.		Other worm Infections.	Latrine Accommodation Rate per cent.
	Ascaris.	Ankylostomes.		
Regent	24	1	12	2·4
Gloucester	27	3	3	2·39
Bathurst	33	—	—	4·3
Lumley	—	11	—	nil
Goderich	71	14	—	nil
Congo Town	60	—	15	5·7
Kissy	50	—	—	3·1
Wellington	not examined.	—	—	3·0
Hastings	"	"	—	1·2
Waterloo	"	"	—	1·3
Rokel	"	"	—	8·0
Aberdeen	"	"	—	nil
Allen Town	"	"	—	nil
Hamilton	"	"	—	nil

It will be noticed that of fourteen schools examined, five or 35·5 per cent. have no latrine accommodation, and that a further four or 28 per cent. have latrine accommodation at a rate lower than 2½ per cent.

Protectorate Schools.—Twelve schools in the Protectorate were inspected during the year and reported on as below:—

School.	Average Attendance.	Latrine Accommodation.
Magburaka	75	bad
Patehun	18	2 cesspits
Makeni Congregational	30	nil
Kumrabai Mamilla	37	nil
Mansumanah United States Congregational	20	nil
Rogbane American Wesleyan Mission	35	nil being constructed
Kamabai	12	nil
Binkolo American Wesleyan Mission	55	smoke latrine
Kabala, C.M.S.	21	nil
Roruks	40	2
Yonni Bannah	50	2 being built
Masemgbo Boarding School	45	cesspit, 3 seats not satisfactory.

V—LABOUR CONDITIONS.

Notwithstanding the world-wide depression in trade with its consequent decrease in shipping, 690 vessels calling at Freetown en route to colonies eastward of Sierra Leone on the West African continent took up 15,876 Kroomen for the handling of their cargo, this figure being approximately 3,500 in excess of the figure for 1930. Furthermore, the various mining activities and the constructional work connected therewith brought into employment a great deal of Protectorate labour which had formerly been purely agricultural. It is estimated that 8,000 men were employed constantly during the year as compared with 3,000 for 1930.

The Assistant Director of Health Service and the Chief Sanitary Superintendent made a very thorough inspection of the Sierra Leone Development Company's Concession, Marampa, and advised on the sites to be selected for the European residences, clerks' quarters and labour camp; and on the rules to be observed both in these places and in the native reservations on the Concession. It is expected that an Order in Council under sections 3 and 4, and Rules under section 6 of the Public Health (Protectorate) (Amendment) Ordinance, 1926, to provide for adequate sanitation on the concession will be passed at an early date.

One thousand men were employed by Maroc, Limited at Makong, and 300 by Sierra Leone Goldfields at Maranda, both in the Northern Province. Mining operations were carried out on a smaller scale at Big Water platinum concession near York; at the chromite concession at Hangha in the Southern Province and at several other isolated points. The Ordinance to provide a Labour Code for Sierra Leone has not yet been passed.

VI—HOUSING AND TOWN PLANNING.

The position of housing and town planning remains materially the same as it was in 1930. The financial depression has prevented any building on a large scale, and it is to be regretted that the data necessary for the completion of the form sent out under the Secretary of States's circular dated 30th June, 1931, are not to hand.

In the Protectorate, some measure of control has been achieved by the declaration of numerous " Health Areas " in which all buildings must obtain the sanction of the " Health Authority " before erection is allowed.

VII—FOOD IN RELATION TO HEALTH AND DISEASE.

The Public Health Ordinances of the Colony and Protectorate contain adequate provisions for the inspection and control of animals intended for the food of man, and of meat and foodstuffs of every description. There is a penalty clause under which action may be taken against persons found in possession of unsound foodstuffs exhibited for sale, but as a rule prosecutions would only be made as a last resort in dealing with offenders after explanations and warnings had failed.

Special attention is given to meat inspection. Freetown is fortunate in possessing probably one of the finest abattoirs in tropical Africa. A tall, spacious building containing separate accommodation for the slaughter of six animals at the same time out of sight of each other; it serves as an ideal centre for the training of the African Sanitary Inspectors in this very important branch of preventive medicine. Adjacent to the abattoir is an area enclosed by an iron fence where the animals are tethered for auction and inspection after disembarkation from the Bullom canoes, and returned again from the grazing grounds for inspection prior to slaughter. The animals are led singly from enclosed lairs to the abattoir and routine inspection of the carcasses is made after flaying and dressing have been completed.

The Freetown Slaughter House Rules were amended this year by the addition of stringent regulations providing for certificates of fitness for the butchers, the prohibition of the removal of meat without inspection and for the cleanliness and better management of the slaughter house. A motor-van with a body specially designed for carrying meat from the slaughterhouse to the city markets has been purchased in order to replace the method which used to be in vogue of carrying the meat for long distances in baskets on men's heads.

At Waterloo and Bonthe, slaughterhouses have been in use for some years. In the Protectorate, concrete slaughterhouses with fly-proof hanging rooms have been built at Moyamba, Makeni, Pujehun and Tanjehun. Funds were not available for the extension of these facilities to other places during the year; temporary structures of palm and thatch are in use at the smaller places. Inspection of all animals before and after slaughter is carried out wherever a Sanitary Inspector is stationed.

At Freetown, the number of animals slaughtered was as follows:—

Bullocks	...	...	...	...	2,818
Sheep	...	...	...	...	433
Goats	...	...	...	...	40
Pigs	...	...	...	...	37

The following seizures were made during the year.

Description.				Cause of Seizure.
1 Carcass	...	...	...	C. Bovis
2 Quarters	...	...	...	C. Bovis
2 Carcasses	...	...	...	Anthrax
1 lb. Liver	...	...	...	Anthrax
103 lbs. Liver	...	...	...	Abscess
10 lbs. Liver	...	...	...	Angioma
133 lbs. Liver	...	...	...	Flukes
24 lbs. Liver Offal	...	...	...	Various

Food Inspection.—A series of inspections of retail provision stores in the Colony and Protectorate resulted in the seizure and destruction of large quantities of foodstuffs of every description, beer, minerals and cigarettes. Daily inspections were made of the premises of the Freetown Cold Storage Company and at the markets of all towns where a Sanitary Inspector is available.

The following table shows the description of foodstuffs seized at different stations.

FREETOWN.

Pork (Pickled)	...	...	1 barrel	Potatoes	...	...	30lbs.
Bacon	...	...	48lbs.	Tomatoes	...	...	312 tins
Bread	...	...	24lbs.	Fruit (tinned)	...	...	8 tins
Corn Flour	...	...	2 packets	Cheese	...	...	46 tins
Rice (milled)	...	...	26 bags	Tea	...	...	11½ lbs.
Rolled oats	...	...	39 tins	Herrings	...	...	3 tins
Petit Pois	...	...	1 case	Anchovy Paste	...	...	20 jars
Margarine	...	...	10 tins	Cigarettes	...	...	135 tins
Ham	...	...	2 tins	Flour	...	...	116lbs.
Sardines	...	...	264 tins	Baking powder	...	...	1 packet
Pilchards	...	...	28 tins	Onions	...	...	272lbs.
Beer 199 qts.	...	...	66 pints	Vegetables	...	...	18 jars
Biscuits	...	...	7½ cases	Milk	...	...	70 tins
Lentils	...	...	4 bags	Camp pies	...	...	1 tin
Cocoa	...	...	27½lbs.	Salmon	...	...	144 tins
Minerals	...	...	63 pints	Cigars	...	...	61 tins

PROTECTORATE.

Pujehun.—Herrings, 12 tins; Sardines, 10 tins; Biscuits, 12 packets.

Makeni.—Sardines, 2 tins.

Moyamba.—Sardines, 47 tins; Salmon, 4 tins; Herrings, 7 tins; Pilchards, 75 tins.

Port Loko.—Bacon, 24 tins.

Sumbuya.—Salmon, 31 tins; Tomatoes, 92 tins; Sardines, 211 tins; Pilchards, 26 tins; Vegetables, 10 tins.

Bakeries, etc.—Five hundred and thirty two inspections were made of bakeries; one hundred and seventy-eight of tanneries, and three hundred and ninety-four inspections of other trades were made.

Reference was made in the Annual Report for 1929 to an outbreak of beriberi in the Freetown Prison, as a result of which a new standard of dietary of high vitamin and caloric value was introduced. This aspect of the food question is fully dealt with in an article written by Dr. Burnett who conducted research work in the various institutions of Freetown. This will be found in Appendix H. Reference will also be found on page 64 to the occurrence of the "A" and "B" avitaminosis disease in pregnant women.

B—MEASURES TAKEN TO SPREAD THE KNOWLEDGE OF HYGIENE AND SANITATION.

Health Week was held from 6th to 12th December.

The following programme was arranged:—

- (1) An article was submitted to the press one week before hand on the subjects of Health Week.
- (2) Sunday, 6th December, was observed as Health Sunday and reference to health matters was made in most of the churches. A letter was sent to all ministers of religion some days beforehand calling attention to the objects of Health Week and the reasons for its institution.
- (3) Large numbers of posters and pamphlets were distributed. The subjects dealt with were:—Malaria and Mosquito Extermination, Plague and Rat Destruction, Smallpox and Vaccination, Tuberculosis and its prevention. Personal and Domestic Hygiene, Ventilation and Diet were also dealt with, and facts given on the prevention of fly-borne diseases and the common infectious diseases of this country.
- (4) Meetings at the Wilberforce Memorial Hall. Public meetings were held daily, His Honour the Governor's Deputy being present at the principal one. Addresses on the different aspects and activities of public health work were delivered by members of the City Council and by the Acting Director of the Sir Alfred Lewis Jones Laboratory.
- (5) An essay competition was held in the schools, the five best essays from each school being submitted. The standard of the essays was high and prizes of cash to the total of £3 10s. were distributed.

- (6) The Baby Competition, as usual, was the principal event of the week. At the preliminary judging of entrants which took place during the week, 33 babies were selected out of approximately 250 at the Princess Christian Mission Hospital and 31 out of 180 at the Campbell Street Clinic for the final judging which took place at Victoria Park on Saturday, 12th December. His Honour the Governor's Deputy attended and distributed prizes to the value of £21 12s. 6d. The Director of Medical and Sanitary Services thanked all those who had so kindly assisted in the catering arrangements for the mothers attending the show.

Hygiene is a compulsory subject in all the schools of the Colony and Protectorate.

C—TRAINING OF SANITARY PERSONNEL.

Lectures and demonstrations were given by the Sanitary Superintendent and Training Officer from 1st January to 14th April, when that officer proceeded on leave.

Training was resumed in October and continued till the end of the year. In all, forty-four lectures were given to two classes of Sanitary Learners and Sanitary Inspectors. All inspectors and learners attended the slaughterhouse for a number of periods of one week each throughout the year, and the majority are becoming quite proficient Meat Inspectors.

Two examinations, one for Sanitary Learners and one for Fifth Grade Sanitary Inspectors were held and two promotions were made. Promotion from Sanitary Learner to Fifth Grade Sanitary Inspector has been held in abeyance owing to the financial position. This is to be regretted as a number of Sanitary Learners who normally would have gone ahead comparatively rapidly have now been in the Department for more than three years, and at present, there is no hope of promotion in sight for them.

D—RECOMMENDATIONS FOR FUTURE WORK.

As regards the recommendations made last year, the following have been carried out:—

- (1) The new system of Refuse Disposal at Freetown was commenced on 14th September, and has since given entire satisfaction. As already stated in the notes under general methods of sanitation, extension of the loading and unloading sidings will become necessary shortly, and a larger number of trucks of an improved type will be required. In the Annual Report for 1932 attention will be drawn to the difference in expense of the last full year's working of the tug and lighters when compared with the cost of working this system for a full year.
- (2) The Water Works Engineer has reported the finding of a suitable source of supply to supplement the Freetown water supply during the dry season. In years when the rains begin late, an acute shortage of water is experienced and considerable inconvenience and hardship are thrown upon the poorer people whose supply of water is from the public stand-pipes. The matter is at present receiving the consideration of the City Council.

As funds permit it is proposed to complete the schemes now held in abeyance, and also to provide further slaughter-houses, public latrines, incinerators and bath-houses in the larger towns of the Protectorate.

V—Port Health Work and Administration.

At Freetown, the principal port of call; 690 ships arrived during the year; 331 from the North, 321 from the South and 38 from Sherbro. All vessels on arrival fly the "Q" flag until pratique is granted by the Medical Officer of Health. Kroo boys are carefully examined on board and undergo vaccination on being put ashore, sick persons on board are examined for signs of infectious disease and all passengers from infected ports are kept under surveillance. During the year, 15,876 Kroo boys were examined. Cabin passengers disembarking at Freetown numbered 1,313 and deck passengers 2,762.

Very few ships arrive at the minor ports of Bonthe, Mano Salija and Sulima without first calling at Freetown. Arrangements are made for the Medical Officer stationed at Bonthe to visit ships when necessary.

During various periods of the year, plague was prevalent at Marseilles, the Canary Islands, Dakar, Lagos and Calabar; smallpox at Lagos, Calabar and Port Harcourt; yellow fever at Lagos and Monrovia. No ports in Sierra Leone were infected with any of the Convention diseases.

A map of Sierra Leone has been incorporated in the new Bulletin of Infectious Diseases the form of which has been altered to bring it into line with the information given us by other Colonies in West Africa. A specimen copy of the new Bulletin is appended as an appendix to this report.

VI—Maternity and Child Welfare.

Maternity and Child Welfare work was well maintained throughout the year, the number of new cases and total attendances showing an increase in many instances. The following table indicates briefly the progress made and includes attendances from fourteen Colony villages.

	Connaught Hospital and Campbell Street Centres.		Princess Christian Mission Hospital.	
	1930.	1931.	1930.	1931.
Ante-natal attendances	2,159	2,829	1,651	1,683
Labour cases admitted	260	251	117	90
Health visits	3,765	3,798	3,995	4,457
Infant Welfare Clinic attendances ...	6,561	7,833	12,001	10,779

In connection with the Infant Welfare Centres, three Health Visitors are employed, two of whom have been trained in England in Welfare Work and have also obtained the certificate of the Central Midwives Board, the third being a locally trained nurse and midwife. The visitors follow up the cases attending the ante-natal clinics and also visit children found ailing at the Infant Welfare Clinics.

Midwives are trained at the Connaught Hospital Maternity section and at the Princess Christian Mission Hospital. An examination is conducted annually with a high standard required for a pass, which entitles successful candidates to registration as Midwives. Some of these are now in private practice, and are being increasingly employed by the public. Legislation is contemplated to place the practice of midwifery on the same status as in Great Britain.

The immigrant natives from the Protectorate, who form the large majority of the inhabitants of Freetown and the Colony, come within the scope of the work of the Infant Welfare Centres. The population of the Protectorate is for the most part rural and that of the more important towns is not large enough to justify the appointment of health visitors or the establishment of maternity and child welfare centres as separate institutions. Facilities are provided at the general hospitals and dispensaries for those who wish to avail themselves. Midwives might be encouraged to take up practice in the larger towns of the Protectorate and so afford an extension to that area of the service already provided in the Colony.

The following tables indicate the real need for the expansion of these services which has been pursued in the Colony in accordance with the scheme initiated in 1927.

Number of deaths in certain periods under one year and during next four years of life (Whole Colony.)

	Number of Deaths.	Death-rate per 1,000 births.
Under one day	60	47·50
1—7 days	85	67·32
1—4 weeks	60	47·50
4 weeks to 3 months	58	45·92
3—6 months	45	35·70
6—9 months	34	26·12
9—12 months	23	18·21

	Number of Deaths.	Death-rate per 1,000 living.
1—2 years	65	46·03
2—3 years	36	17·98
3—4 years	24	13·45
4—5 years	14	7·16
Total under 5	504	—
Deaths at all ages ...	1,380	24·84

Principal Causes of Deaths under twelve months, 1931.

Causes.	Freetown (including Clinetown).	
	Number.	Percentage.
Prematurity	53	14.52
Heart Failure	49	13.42
Fever	49	13.42
Infantile Convulsions	53	14.52
Bronchitis	38	10.41
Congenital Debility	19	5.20
Broncho-Pneumonia	17	4.65
Asthenia	10	2.73
Malaria	9	2.46
Destitution of Appetite	9	2.46
Infantile Diarrhoea	8	2.19
Tetanus Neonatorum	6	1.64
Enteritis	6	1.64
Atelectasis (collapse)	6	1.64
Inanition	5	1.36

It will be observed again this year that a very high percentage of the deaths under one year fall into the earlier age groups and that a great number of the deaths were due to causes which might easily have been prevented by a knowledge of mothercraft. It is therefore gratifying to record that increasing interest is being shown in this subject in the girls' schools in Freetown.

Reports from the Medical Officer in charge of the Maternity and Child Welfare Centres will be found in Appendices B and C. Pages 61-65.

J. A. A. DUNCAN,
Assistant Director of Health Service.

VII—Hospitals, Dispensaries and Clinics.

(a) CONNAUGHT HOSPITAL.

A new children's ward, with beds and cubicle was opened at the beginning of the year and has been a great improvement. Children had been treated formerly in the female wards. The new children's ward was built over the former flat roof of the operating theatre block.

There has been a falling off in the number of new cases seen in the Out-patients Department, but the subsequent attendances show a considerable increase.

The number of In-patients fell a little from the peak number of the previous year 2,383 to 2,335. As the Surgical Specialist was absent on leave for five months of the year, and the number of operations performed at this Hospital dropped from 1,304 to 1,157, there was an increase in other than surgical cases. The report of the Surgical Specialist will be found in Appendix A, page 59, and Notes on Special Cases in Section IX, Scientific, on page 37.

The Electrical Department continued its career of usefulness but some difficulty was experienced, owing to clouding of intensifying screens and safelight glasses due to the combination of excessive heat and humidity. Correspondence with the manufacturers, and with the Electrical Department of the Gold Coast Hospital has ensued, and it is hoped that this difficulty will be at least ameliorated. Dr. Jennings, on leave at present, has the matter in hand, and is making further enquiries.

The maternity cases keep up their numbers well, and the steady increase since the new hospital opened in 1921 is gratifying. The Special Report on the Maternity Ward will be found at Appendix B, page 61.

The following table shows the figures of in-patients and maternity cases admitted to the Connaught Hospital since its opening in 1921; it is gratifying to note the steady increase of patients who come for institutional treatment.

Year.	Total In-patients.	Maternity In-patients.	REMARKS.
1921	737	142	New hospital opened—four wards in January including maternity ward of eleven beds. Two more wards in August.
1922	1,282	169	
1923	1,557	200	
1924	1,862	263	
1925	1,860	214	
1926	1,867	251	
1927	2,046	301	
1928	1,945	311	
1929	2,228	353	
1930	2,383	363	
			New Surgical block, two wards of fourteen beds and four cubicles.
1931	2,335	357	New children's ward, 10 beds and 1 cubicle.

Out-patients at the Connaught Hospital during the past ten years:—

—	1922.	1923.	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
New Cases ...	10,573	11,335	10,955	14,106	13,834	14,780	13,864	14,265	14,276	10,583
Subsequent Attendances	10,443	36,985	38,475	22,335	32,176	34,780	47,040	59,441	41,722	50,059
Total ...	21,016	48,320	49,430	36,441	46,010	49,560	60,904	73,706	55,998	60,642

(b) EUROPEAN HOSPITAL.

During the year forty-four officials and forty-eight non-officials were treated in the European Hospital. These figures are well below those of 1930 when 121 cases were admitted. Scrutiny of the admissions discloses this marked reduction principally in the non-official category, and can be attributed to the reduction in the shipping visiting the port and in the European staffs of the Trading Firms. There were three deaths due to the following causes:—

Blackwater Fever	...	...	...	...	...	1
Malaria M.T. (Hyperpyrexia)	...	...	...	...	...	1
Peritonitis	...	...	...	...	...	1

—	Admissions.	Deaths.
Government officials	44	1
Non-officials	48	2
Total	92	3

(c) OTHER HOSPITALS.

There are two Protectorate type hospitals at Makeni and Bo, in the Northern and Southern Provinces, respectively.

The figures of attendances are as follow:—

MAKENI:						
In-patients ...	...	...	...	...	...	213
Out-patients (new) ...	...	...	...	...	...	2,900
Subsequent attendances	...	...	...	...	...	13,929
Operations ...	...	...	...	...	...	65

The Medical Officer, Makeni, writes:—"Elephantiasis Scroti varying in size from 15 to 124 pounds, Hernia and other surgical complaints have lately been coming forward for treatment in large numbers, so much so that some patients have had to wait as long as three months for accommodation and many were advised to proceed to Freetown for operation."

Bo:

In-patients ...	...	...	...	...	...	105
Out-patients (new) ...	...	...	...	...	...	1,988
Subsequent attendances	...	...	...	...	...	12,833
Operations ...	...	...	...	...	...	21 (in last six weeks)

The Medical Officer, Bo, writes:—"The present Medical Officer was in Bo only the last six weeks of the year. There has been a fairly big drop in the number of new cases coming to hospital for which no explanation is forthcoming. The number of subsequent attendances has increased, which may be taken as proof that those treated have appreciated the care and attention given them.

In the last six weeks an attempt has been made to build up the surgical side of the work and with some measure of success. The natives are, I think, definitely keen on operations—in proof of which is the fact that we already have a waiting list. The cases coming for operative relief are composed of women as well as men."

Other hospitals in the Protectorate, either partly or wholly of native construction are at Port Loko, Kabala, Moyamba, Pujehun, Sumbuya and Daru. These vary from eight to fourteen beds and serve large districts.

(d) MISSION HOSPITALS SUBSIDISED BY GOVERNMENT.

There are three of these hospitals, each with a Medical Officer and one or two Nursing Sisters. Two are situated in isolated districts a long way from a Government medical station, one at Kamakwee, in the North West of the Northern Province and the other at Jaiama, in the very backward Kono District. Both of these are maintained by American Missions. The third is established at Segbwema, on the main railway line, in the centre of a densely populated district. This is maintained by the British Wesleyan Mission, and has a fine range of permanent and up-to-date buildings.

These Medical Missions are doing excellent work, which is steadily increasing in scope. The figures returned by the Mission Hospital at Jaiama, Kono District, for the year 1931, are as follows:—

In-patients ...	...	...	...	...	...	116
Out-patients (new cases)	...	{		Male ...	...	2,954
				Female	...	2,085
				Total	...	5,039
Subsequent attendances	...	...	...	...	...	15,543

(e) GOVERNMENT DISPENSARIES.

There are seven of these established in the Colony and nine in the Protectorate; they are staffed by the more experienced dispensers, each of whom is assisted by a hospital porter. Those in the Protectorate are visited either once or twice a month, depending on accessibility, by the Medical Officer of the district, and in addition to supplying simple remedies and dressings to the local population, serve as feeders to the district hospitals.

VIII—Meteorology.

The rainfall for the year at Freetown (Tower Hill)—147·28 inches—was considerably higher than the rainfall for 1930, which was 114·5 inches; but below the forty years average for the period 1882–1921, which was 152·47 inches. July was the month of heaviest rainfall with 40·65 inches. The highest rainfall recorded in any one day was 7·65 inches on the 9th July. The lowest temperature recorded at the Tower Hill Observatory was 64 degrees on the 8th October; the highest 94 degrees on the 24th and 25th April.

Hill Station, the residential area, situated on a ridge immediately to the West of Freetown, always has a heavier rainfall than Tower Hill. The total for the year was 190·58 inches, July with 55·46 inches being the month of heaviest rainfall. The maximum precipitation in one day was 9·66 inches on the 9th July.

IX—Scientific.

A—CONNAUGHT HOSPITAL LABORATORY REPORT.

Dr. Renner was in charge for the greater part of the year, Dr. Jennings taking over from him when he went on leave.

During the year 7,956 specimens were examined.

(1) *Blood Examination.*

Total Blood Slides	...	...	...	1,987
Africans	...	...	...	1,697
Europeans	...	...	...	290
			Africans.	Europeans.
Subtertian	...	...	286	53
Benign tertian	...	..	2	—
Quartan	...	...	18	8
Crescents	...	...	2	2
Hæmoglobin	...	...	9	6
Red Count	...	...	12	5
Differential Count	...	...	21	24
Microfilaria bancrofti	...	...	7	—
Microfilaria perstans	...	...	1	—
Trypanosoma gambiense	...	...	1	—
Total White Count	...	...	24	27

(2) *Fæces Examination.*

Total Examined	...	...	...	1,378
Africans	...	...	...	1,307
Europeans	...	...	...	71
			Africans.	Europeans.
Ascaris ova	...	...	161	1
Ankylostome	...	...	269	—
Tænia	...	...	23	—
Trichuris	...	...	73	—
D. Dentriticum	...	...	6	—
Larva of Strongyloides	...	...	114	1
E. Histolytica	...	...	67	4
E. Coli	...	...	7	—
Giardia	...	...	1	—
Blast Hominis	...	...	1	—
Blood	...	...	30	3
Mucus	...	...	30	3
Pus	...	...	23	1
Cellular Exudate	...	...	30	2

(3) *Urine Examination.*

Total Examined	...	...	...	1,033
Africans	...	...	...	916
Europeans	...	..	...	117
			Africans.	Europeans.
Albumen	...	...	249	28
Sugar	...	...	11	—
Acetone	...	...	2	—
Diacetic Acid	...	...	2	—
Pus	...	...	33	12
Blood	...	...	22	2
Casts	...	...	4	2
S. Hæmatobium Ova	...	...	3	—
Gonococcus	...	...	10	6

(4) *Sputum Examination.*

Total Sputa Examined	...	...	...	227
Africans	...	...	...	210
Europeans	...	...	...	17
			Africans.	Europeans.
Tubercle bacilli	...	...	33	3
Streptococcus	...	...	4	3
Pneumococcus	...	...	17	1

(5) *Smears from V.D.C., etc.*

Total Examined	...	...	...	...	193
Africans	...	...	...	...	174
Europeans	...	...	...	...	19
Gonococcus	...	...	...	93	10
Secondary Organisms	...	...	...	23	—
Spirochaetes	...	...	...	4	—

Positive. Negative.

(6) *Kahn Tests.*

Total Tests	...	...	...	...	8
Africans	...	...	4	1	3
Europeans	...	...	4	2	2

(7) *Agglutination Test.*

Total Test	...	...	...	...	6
Africans	...	...	4	1	3
Europeans	...	...	2	2	—

(8) *Miscellaneous.*

				Africans.	Europeans.
Pus smears	...	...	...	18	—
Ulcer scraping	...	...	...	4	1
Throat smears	...	...	...	2	—
Knee joint fluid	...	...	...	3	—
Cerebro spinal fluid	...	...	...	1	—
Stool culture	...	...	...	2	1
<i>Lepra Bacilli.</i>					
Number Examined	...	...	...	...	88
Number Positive	...	...	...	...	17

Total number of specimens examined from Freetown Prison ... 333

Two thousand six hundred smears from rats were examined and no evidence of plague infection was found.

(9) Seventy post mortem examinations were performed.

Natural Causes —

Diseases of heart	...	...	...	...	...	8
Lobar pneumonia	...	...	...	...	...	7
Pulmonary T. B.	...	...	...	...	...	3
Œdema of lungs	...	...	...	...	...	3
Other Pulmonary conditions	...	...	...	...	...	5
Acute pericarditis	...	...	...	...	...	5
Nephritis	...	...	...	...	...	4
General œdema and pericarditis	...	...	...	...	...	9
Internal hæmorrhage	...	...	...	...	...	2
Liver abscess	...	...	...	...	...	1
Carcinoma of liver	...	...	...	...	...	1
Meningitis	...	...	...	...	...	2
Cerebral congestion	...	...	...	...	...	1
Malaria	...	...	...	...	...	1
Peritonitis	...	...	...	...	...	2
Gastro enteritis	...	...	...	...	...	1
Toxaemia	...	...	...	...	...	1
—	—	—	—	—	—	1
Embolism	...	...	...	...	...	1
Total	...	...	...	...	...	58

Unatural Causes :—

Fracture skull and Compression	...	...	...	...	...	7
Shock	...	...	...	...	...	1
Drowning	...	...	...	...	...	1
—	—	—	—	—	—	1
Corrosive poisoning	...	...	...	...	...	1
Septicaemia after fracture	...	...	...	...	...	1
Total	...	...	...	...	...	21

C. B. JENNINGS,
Medical Officer in Charge.

B—NOTES ON SURGICAL CASES.

1.—TWO CASES OF TYPICAL GAS GANGRENE.

Gas gangrene is seen from time to time in Freetown and the following two cases occurred during the year. In contrast to this I have not treated a case of tetanus in the surgical clinic in four-and-a-half years.

1. A farmer, thirty-four years old was admitted with an incised wound of the right arm severing the biceps and coraco-brachialis and a wound of the left hand forming a compound fracture involving the meta carpo-phalangeal joint of the index finger.

Temporary stitching was done in the out-patient department 18th January, 1931 and I re-opened the right arm wound next day 19th January, 1931 in order to see if any important structures had been damaged. Repair was effected, the wound being pipped and closed. On the morning of the 21st he complained of severe pain in the arm and on examination enlargement of the whole arm distal to the wound was observed. On palpation the ominous sign of crackling of gas was evident. An immediate amputation was performed through the upper one third of the arm but the patient went down hill rapidly and died a few hours later.

2. A labourer, aged twenty-four was admitted on 1st December, 1931 with a compound fracture of the left forearm and a fractured left femur. The wound was immediately disinfected and closed and the fracture set. On 4th December, 1931 pain was felt and puffiness of the arm observed in the neighbourhood of the wound. On palpation crepitations were detected. Amputation was performed right away through the median third of the arm but this failed to save the patient's life.

The rapidity of advance in both these cases was remarkable. On post mortem all the typical signs of gas gangrene were observed.

2.—ANEURYSM OF THE SUBCLAVIAN ARTERY.

A man of fifty years of age was seen complaining of a swelling of the right side of the neck accompanied by pain and weakness of the right arm. First noticed eight months ago it had steadily increased since. On examination a large pulsating swelling was to be seen in the right side of the neck approximately filling the posterior triangle. The pulse at the right wrist was very much weaker than at the left and muscular atrophy was evident on that side.

An aneurysm of the right subclavian artery was diagnosed.

On 20th January, 1932 an operation was performed under colonic ether. An incision was made along the anterior border of the sterno-mastoid and carried backwards along the clavicle for four inches. The flap was reflected and the sternomastoid, sterno hyoid, and sterno thyroid cut one inch above the sternum. The inner one-and-a-quarter inches of the clavicle were then resected. The common carotid artery was defined and followed down to the innominate artery which showed marked bulging of atheromatous walls. The origin of the dilated subclavian artery was defined. The common carotid was ligatured with a double strand of No. 2 silk and used as a tractor to make ligature of the innominate below the bifurcation possible; this was very deeply situated and it was with some difficulty that a kangaroo tendon was got round the innominate and tied. Pulsation now ceased in the subclavian swelling. The operation was not so difficult as one had imagined and the patient left the table quite fit—unfortunately he died suddenly some three hours later apparently from heart failure.

3.—A LARGE HYDRONEPHROSIS.

A young man of twenty-two was admitted complaining of swelling of the abdomen since he was a small boy and of constipation. He gave a history that the swelling was sometime bigger than at other times and that he had noticed when it became smaller he passed a large quantity of water.

On examination, a large tumour was to be seen and felt mainly occupying the left side of the abdomen but extending beyond the mid line. It was rounded in outline and gave the impression of being a fluid swelling.

Cystoscopy was done and indigo carmine injected; this was returned from the right side as late as eighteen minutes and not at all from the left.

A barium enema did not give any information. The urine was negative; ankylostomes were found in the faeces, and microfilaria bancrofti in the blood.

Weight decreased steadily while under observation. Hydronephrosis of the left kidney was diagnosed. On account of the late appearance of indigo carmine from the right side operation was regarded with some dubiety. However, the patient was anxious for something to be done. Under spinal anæsthesia the abdomen was opened through a left paramedian incision (it was estimated that removal of so large a tumour would be difficult by the lumbar route) and an enormous hydronephrosis was encountered. The descending colon was mobilised and turned over to the right. The right kidney felt normal and as no useful tissue remained on the left nephrectomy was done and a drain left in the flank.

Following operation there was some trouble with abdominal distension but pituitrin and enemas put this right and convalescence was uneventful.

4.—ECTOPIC KIDNEY.

A policeman, thirty-two years of age came complaining of pain in the abdomen of short duration. On examination, there was to be felt a tumour in the right ilio-lumbar region; this was the size of a medium mango and moved on respiration; it was somewhat tender on palpation.

On cystoscopic examination and injection of indigo carmine none was observed to be excreted from either kidney; by thirty minutes later it was reported in the voided urine. This result made one doubtful about operative procedure.

However an exploratory laparotomy was decided on and the abdomen opened by a right-paramedian incision. A deformed kidney was found in the right iliac fossa; the ureter was split up into several branches and there was no pelvis; it was very moveable and the appendix was adherent to it. The left kidney appeared to be normal on palpation and it was decided to excise the ectopic kidney; this was done together with an appendicectomy. Convalescence was distinctly stormy but the patient was ultimately discharged in a slowly improving condition.

5.—AMOEBIC ULCERATION OF THE CAECUM SIMULATING CARCINOMA.

A railway guard, thirty-eight years old came with a complaint of abdominal pain and alternating constipation and diarrhoea of two months duration. He had been under treatment as an out-patient and had been gradually losing weight and obviously going down hill. He was admitted to hospital. On examination the patient was thin and in a poor state of nutrition. An irregularly rounded tumour was present in the right lumbar region; it was dull on percussion, moved on respiration and was tender; it felt like an enlarged kidney and its position though somewhat low suggested this.

Cystoscopic examination with injections of indigo carmine showed both kidneys to be acting normally. *Entamoeba histolytica* were found in the stool and a course of emetine (gr. one daily for ten days) given; this caused some improvement in his condition and amoebae disappeared from the stool but the tumour remained unaffected. Operation was then decided on.

The abdomen was opened by a right paramedian incision and the tumour was found to be situated in the caecum involving the ileo-caecal junction; it was about the size of a tennis ball and there was considerable oedema present in the vicinity along with enlarged glands. The portion of bowel involved was excised and the ileum anastomosed to the transverse colon. Convalescence was uneventful.

On opening the excised portion of bowel a very large ulcer was found extending over the mucous membrane of the caecum and surrounding the ileo caecal junction; in places the ulcer edges were raised and somewhat hard but the glands were soft and the condition did not suggest malignancy. The marked infiltration of the tissues in the vicinity had accounted for the tumour formation. Owing to the lack of a pathologist a section report is not yet to hand.

6.—STRICTURE OF THE SMALL INTESTINE AT THE CONSTRICTION RING FOLLOWING INGUINAL HERNIA.

A man of forty-seven was admitted with enlargement of the abdomen which was given rise to pain of a colicky nature, this had lasted for nine months.

He gave a history which is of considerable importance in view of the condition found at operation. He had been operated on for right inguinal hernia nineteen years before and this had recurred and been operated on by me four months previous to admission. No history of the hernia being strangulated or irreducible could be obtained. He began to suffer from attacks of colicky pain accompanied by distension five months before his admission for the recurrent hernia operation; this pain came on at any time and was occasionally accompanied by vomiting. The symptoms were entirely unrelieved by the herniotomy and the abdomen became permanently distended. On examination the abdomen was found to be distended with free fluid and on drawing off two pints of this peristalsis and distension of gut was visible. A diagnosis of subacute intestinal obstruction was made, probably of a malignant nature.

The abdomen was opened under spinal through a right para-median incision—a large quantity of clear yellow fluid was evacuated by suction; a section of greatly distended small intestine then came into view. On tracing this distended loop it was seen to end in a thickened ring like constriction of the gut distally, while proximally it tailed off gradually into intestine which was markedly hypertrophied for some distance. Enlarged glands were present in the mesentery. The affected segment of gut was excised and an end to end junction done. On slitting up the specimen after removal a curious inflammatory condition of the mucous membrane was seen to exist at either end of the dilated portion, the distal end being much more markedly affected, here was an almost complete ring-like stricture with very dark and congested mucous membrane studded with small wart like growths proximally, the other end of the dilated portion showed an almost similar appearance but much less advanced. It was quite evident that at one time this portion of the bowel had been the contents of a hernia presumably the inguinal hernia, that partial strangulation had taken place and that this had been reduced leaving however damage to the bowel wall at the constriction ring sites; chronic inflammatory tissue had been laid down there and stricture had ultimately taken place at the more advanced end. Sections were cut to exclude malignancy and the report for which I am indebted to the Conservator the Royal College of Surgeons, Edinburgh is as follows:—

“In the bowel beyond the structure the epithelium and glandular structure is preserved but there is an infiltration of the mucosa with inflammatory cells (lymphocyte and Eosinophil). The warty portions show loss of surface epithelium and of glandular structure with surface ulceration and infiltration of the mucosa with inflammatory cells. The inflammatory process extends through the muscular coat to the serosa. No tubercle. No malignancy.”

Q. STEWART F.R.C.S.,

Surgical Specialist.

C.—NOTES ON LEPROSY IN SIERRA LEONE WITH SPECIAL REFERENCE TO NOTES WHICH APPEARED IN THE ANNUAL REPORT FOR 1930.

ELEPHANTIASIS OR LEPROSY.

The earliest complete record we have of the practice of medicine in the Colony of Sierra Leone is that written by Winterbottom and published in 1803. The book is full of useful information and contains most accurate observations.

In “Notes on a Survey of Leprosy in Sierra Leone,” published in the Annual Report of the Medical and Sanitary Department, Sierra Leone, 1930, there appears the statement that Dr. Winterbottom “makes no mention of leprosy, though other tropical diseases as yaws, elephantiasis, dracunculus, craw-craw, smallpox are noticed.”

The whole of Chapter IV of Winterbottom’s book is devoted to elephantiasis and opens as follows:—

Elephantiasis, or lepra arabum, has been so called from the resemblance which the diseased skin particularly that of the legs and feet bears to tuberculous, chopped and rugged hide of an elephant.....It is moreover called leontiasis from the thickened state of the eyebrows and the rugose appearance of the forehead, especially towards the temples and angles of the eyes, which was compared to the countenance of a lion when enraged. Celsus calls it elephantia, and by others it is termed elephas.....The Arabians made a distinction between elephantiasis and elephas; in the former, the disease is spread over the body, in the latter, it is confined to the leg, which becomes enlarged with varicose veins, a great thickening of the skin, and a prodigious deposition in the adipose membrane.

From this it seems that some confusion in the use of the term elephantiasis existed and towards the end of the chapter, Winterbottom discusses the matter.

After making further historical notes Winterbottom proceeds to describe the first well marked case of the disease which he saw in Africa. The patient was a Foola who came from Callesar near Teembo to seek medical advice at Sierra Leone. The only visible appearance of disease in him consisted in several discolourations of the skin rather larger than a crown piece, situated on arms, trunk and legs.

A slight change of colour had taken place upon the edge of the upper lip, near the angle of the mouth, and a small part of the right ala nasi likewise appeared thickened and discoloured. The parts of skin thus discoloured were totally devoid of sensibility. This patient gave the information that the disease was very frequent in the Foola country and mentioned an instance of a man whom he knew whose hands dropped off at the wrists in consequence of this disease and had married a woman afflicted with the same complaint and had from the marriage three sons who were still alive and grown up but only one of them was affected with elephantiasis.

Winterbottom says that the Foolas, Soosoos and Madingoes distinguished three species of the disease:—

- (1) The skin is merely discoloured and insensible.
- (2) In addition to this insensibility and discolouration of the skin, the joints of the fingers and toes are affected with spreading ulcerations; they become enlarged and drop off. Lobes of the ears are thickened and enlarged and discharge a thick viscid matter. The lips are much swollen and the ala nasi are tumefied and ulcerated.
- (3) Is chiefly characterised by the voice which becomes hoarse and guttural because of the great and spreading ulceration in the throat and fauces. Together with the affections of the throat and nose the neck is much tumefied; the ears are more and more ulcerated, the legs and feet deprived of the toes, enlarge greatly and entirely lose their form.

This description concluded, he narrates having seen two cases on the Island of Bananas but from his description one of the cases does not appear to be leprosy.

He also describes anaesthetic patches and loss of fingers and toes in a woman, aged about forty years, and yet another case in a young man residing at False Cape, Sierra Leone.

After discussing the aetiology of the disease he says “A just distinction has not yet been made between lepra and elephantiasis as the description of these diseases by different authors may be mutually mistaken for each other.....Through inattention, enlargements of the legs with thickening of the integuments, from whatever cause they originated, have been considered as elephantiasis.” He refers to Dr. Hillary having committed an error when he described under the title elephantiasis a disease which is endemial in Barbados, and therefore called Barbados leg but which bears no other resemblance to true elephantiasis than the increase of bulk in limb. It is relevant to note here that in Chapter VI, Winterbottom describes enlargement of the scrotum and enlargement of the legs—the condition is obviously what to-day is termed elephantiasis. Referring to the leg he says “It generally affects but one leg, and seldom rises above the knee; the swelling is hard and firm, does not pit on pressure, and is entirely free from pains.”

As an example of enlargements of the scrotum he quotes the case of a young man in whom the disease had advanced more rapidly than usual as he had only been affected four years. He says “The tumour reached nearly as low as his knees, and might probably weigh twenty pounds. The penis was entirely concealed in the skin of the scrotum, as in a large hydrocele. The testes were distinctly to be felt in the upper part of the tumour, pressed close to the penis, and were of the natural size. The spermatic cord was neither enlarged nor painful. The lower part of the tumour had acquired an almost cartilaginous hardness, and the surface was deeply furrowed; on the sides, the integuments were apparently much thickened, and there seemed to be an obscure degree of fluctuation within.” On the strength of this last observation Winterbottom stuck a trocar in the swelling but only a few drops of blood escaped.

The object of this note is to show that Winterbottom recognised both leprosy and elephantiasis, that leprosy was a prevalent disease when the Colony of Sierra Leone was in its infancy and to draw attention to his use of the old nomenclature of the disease.

E. JENNER WRIGHT.

Tables.

I—MEDICAL STAFF.

Office.	Name.	Absent on Leave.						Remarks.
		From			To			
Director of Medical and Sanitary Services ...	J. C. S. McDouall ...	2	5	31	1	10	31	
Surgical Specialist ...	Q. Stewart ...	7	3	31	6	8	31	
Senior Medical Officer	G. H. Gallagher ...		—		9	1	31	
„ „ ...	B. W. F. Wood ...	21	11	31		—		
Medical Officer ...	E. S. Walls ...	17	10	31		—		
„ ...	A. W. Lewis ...		—			—		
„ ...	A. M. Wilson-Rae ...		—			—		Transferred from Bathurst Gambia
„ ...	C. B. Jennings ...		—		19	2	31	
„ ...	G. L. Alexander ...	16	5	31		—		Transferred to the Gold Coast
„ ...	H. J. Bermingham ...		—		21	5	31	Transferred to Bathurst
„ ...	W. Allan ...	16	5	31	27	11	31	Gambia
„ ...	R. B. Henderson ...	14	4	31	17	9	31	
„ ...	H. R. F. Tweedy ...	2	5	31	1	10	31	
„ ...	H. Peaston ...	22	8	31		—		
„ ...	A. Cathcart ...	19	12	31		—		
„ ...	T. H. Dalrymple ...		—			—		Appointed M.O.W.A.M.S 25-3-31.
„ ...	W. A. Burnett ...		—			—		Appointed M.O.W.A.M.S 23-9-31.
Lady Medical Officer	M. M. McDowall ...	7	3	31		—		Transferred to Gold Coast
African Medical Officer	E. J. Wright ...		—			—		
„ ...	M. C. F. Easmon ...		—			—		
„ ...	E. H. T. Cummings ...	16	7	31	25	12	31	
„ ...	G. N. Metzger ...		—			—		
„ ...	E. A. Renner ...	15	9	31		—		
„ ...	W. B. Hughes ...		—			—		
„ ...	W. F. O. Taylor ...		—			—		
„ ...	M. A. S. Margai ...		—		22	4	31	

SANITARY STAFF.

Assistant Director of Health Service ...	J. A. A. Duncan ...	12	10	31		—		
Senior Health Officer	A. B. Monks ...		—		19	2	31	
Medical Officer of Health ...	R. F. Campbell ...	22	3	31	27	11	31	
Sanitary Superintendent and Training Officer ...		19	12	31		—		
„ ...	G. V. Herd ...	14	4	31	15	10	31	
Superintendent Sanitary Inspector ...	A. E. Wilkinson ...	7	11	31		—		
„ ...	P. Osment ...		—		27	3	31	

SING STAFF.

Senior Nursing Sister	Miss A. E. MacMaster	25	7	31	27	11	31	
„ „ ...	Miss I. A. Marr ...	19	4	31	3	9	31	
Nursing Sister ...	Miss C. H. B. Goodwin		—			—		
„ ...	Miss M. A. Henry ...		—		30	1	31	
„ ...	Miss L. D. S. McPetrie		—		19	3	31	
„ ...	Miss N. M. Brown ...	7	2	31	9	7	31	
„ ...	Miss A. M. Pearton	8	8	31		—		Transferred to Gold Coast

AFRICAN MEDICAL SUBORDINATE STAFF.

Office.	Name.	Absent on Leave.		Remarks.
		From	To	
Chief Dispenser ...	I. H. Wright ...	—	—	
Assistant Chief Dispenser ...	M. O. Frazer ...	1 4 31	31 5 31	
Hospital Warden ...	P. Q. A. John ...	—	12 2 31	
First Class Dispenser	O. V. E. Nylander ...	—	—	
" "	H. E. Frazer ...	—	—	
" "	P. J. John ...	22 5 31	21 7 31	
" "	M. P. Neville ...	28 4 31	27 6 31	
" "	I. B. Doherty ...	22 2 31	21 4 31	
" "	T. M. T. Scott ...	—	—	
" "	J. C. May ...	—	—	
" "	S. B. Williams ...	—	—	
" "	E. W. Cole ...	15 4 31	14 6 31	
" "	G. C. Heroe ...	—	—	
Second Class Dispensers	Ten	—	—	
Third Class Dispensers	Fourteen	—	—	
Laboratory Assistant ...	C. H. Greene ...	17 12 31	—	
Male Nurses and Apprentices ...	Thirty-three	—	—	
Female Nurses and Probationers ...	Twenty-five	—	—	
Midwives ...	Two	—	—	

AFRICAN SANITARY SUBORDINATE STAFF.

Health Visitors ...	Mrs. V. Shaw-Macfoy and others	5 2 31	24 3 31	
Third Grade Sanitary Inspector ...	W. E. J. Corkson ...	—	—	
Fourth Grade Sanitary Inspectors ...	Six	—	—	
Fifth Grade Sanitary Inspectors and learners ...	Thirty-three	—	—	

MEDICAL AND SANITARY CLERICAL STAFF.

Chief Clerk ...	S. G. Randall ...	—	—	
First Grade Clerk ...	M. St. George Auber	—	—	
Second Grade Clerk ...	C. B. K. M'earthy ...	6 2 31	9 4 31	
Senior Third Grade Clerks ...	Ten	—	—	
Junior Third Grade Clerks ...	Five	—	—	

MEDICAL STORE-KEEPING STAFF.

Chief Store-keeper ...	K. A. King ...	—	—	
Assistant Store-keeper	E. J. Beale ...	—	—	
" "	D. G. Kawaley ...	—	—	

II—FINANCE.

1931 Estimates.—Expenditure.

MEDICAL.

Personal Emoluments:							£
European	...	...	...	...	...	...	16,993
African	...	...	...	...	...	...	20,680
Allowances, etc.		...	...	...	...	...	1,911
				Total	...	...	<u>£39,584</u>

Other Charges :

Charges :						£
Medical supplies and hospital equipment ...	...	...	...	...	...	6,830
Diets, provisions, etc. ...	...	...	...	...	...	5,500
Contributions to various associations and					subsidies to	
Institutions ...	...	...	...	...	...	3,060
Passages, transport, freight, etc. ...	...	...	...	...	...	4,400
Other items ...	...	...	...	...	...	1,940
						<hr/>
					Total ...	£21,730

SANITARY.

Personal Emoluments :							£
European	...	...	...	...	...	...	5,503
African	...	...	...	...	...	...	5,291
Labour	...	...	...	...	...	...	9,600
Total							£20,394

Other Charges :

Charges :						£
Refuse disposal	...	...	...	...	...	1,450
Preventive measures	...	...	...	...	...	1,500
Apparatus	...	...	...	...	...	615
Transport	...	...	...	...	...	1,140
Other items	...	...	...	...	...	295
						<hr/>
			Total	...	...	£5,000

RECEIPTS.

RECEIPTS.						£
African hospital fees	...	...	...	...	...	212
European hospital fees	...	...	...	...	...	512
Lunatic hospital fees	...	...	...	...	...	291
Sale of medicines	...	...	...	...	...	618
Total						£1,633

III—RETURN OF DISEASES AND DEATHS—EUROPEAN.

Diseases.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in Hospital at end of 1930.	Total Admission.	Total Cases treated.	Deaths.	Remaining in Hospital at end of 1931.	New Cases treated.	Subsequent Attendances.
I—EPIDEMIC, ENDEMIC, AND INFECTIOUS DISEASES							
5. Malaria :							
(b) Quartan ...	...	4	4	...	...	3	
(c) Aestivo-autumnal ...	1	22	23	1	...	10	
(d) Cachexia ...	...	2	2	...	1	...	
(e) Blackwater ...	...	1	1	1	...	...
(f) Unclassified ...	...	...	...	..	...	28	
10. Diphtheria ...	...	...	...	...	...	1	
11. Influenza ...	...	8	8	...	...	5	
16. Dysentery :							
(a) Amæbic ...	...	1	1	...	...	...
(b) Bacillary ...	...	1	1	...	...	...
(c) Undefined or due to other causes ...	...	1	1	...	...	1	
31. Tuberculosis, pulmonary and laryngeal ...	...	1	1	...	...	1	
40. A.—Gonorrhœa and its complications ...	...	...	...	...	...	3	
II—GENERAL DISEASES NOT MENTIONED ABOVE.							
50. Tumours, non-malignant	...	1	1	...	...	...
51. Acute rheumatism ...	...	...	...	...	...	1	
52. Chronic rheumatism ...	...	2	2	...	...	6	
58. Anæmia :							
(b) Other anæmias and chlorosis ...	...	1	1	...	...	15	
69. Other General Diseases :	...	...	...	...	...	1	
III—AFFECTIONS OF THE NERVOUS SYSTEM AND ORGANS OF THE SENSES.							
75. Paralysis :							
(b) Other paralysis ...	...	1	1	...	...
77. Other forms of mental alienation ...	...	2	2	...	...	...
78. Epilepsy ...	...	1	1	...	...	...
82. B.—Neuritis ...	...	...	...	...	...	2	
84. Other affections of the nervous system ...	...	...	...	...	...	45	
Carried forward ...	1	49	50	2	1	122	

The form shows in the main the arrangement of diseases in the International Nomenclature, 1921 Edition. To save space the unimportant diseases of any class can be grouped in their places as “ Other Diseases of the class.

EUROPEAN—*continued.*

Diseases.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in Hospital at end of 1930.	Total Admission.	Total Cases treated.	Deaths.	Remaining in Hospital at end of 1931.	New Cases treated.	Subsequent Attendances.
Brought forward ...	1	49	50	2	1	122	
III—AFFECTIONS OF THE NERVOUS SYSTEM AND ORGANS OF THE SENSES, <i>continued.</i>							
85. Affections of the Organs of Vision:							
(a) Diseases of the eye ...	...	1	1	...	1	20	
(e) Other affections of the eye ...	...	...	...	...	...	3	
86. Affections of the ear or mastoid sinus ...	...	...	...	...	...	11	
IV—AFFECTIONS OF THE CIRCULATORY SYSTEM.							
90. Other Diseases of the Heart							
(b) Myocarditis ...	...	1	1	...	...	2	
93. Diseases of the Veins :							
Hæmorrhoids ...	...	...	...	...	...	5	
Phlebitis ...	...	1	1	...	...	2	
94. Diseases of the Lymphatic System :							
Lymphangitis ...	...	1	1	...	1	...	
Lymphadenitis, bubo (non-specific) ...	...	2	2	...	...	2	
95. Hæmorrhage of undetermined cause ...	...	...	...	...	...	1	
96. Other affections of the circulatory system ...	...	...	...	...	...	1	
V—AFFECTIONS OF THE RESPIRATORY SYSTEM.							
97. Diseases of the Nasal Passages ...							
Coryza ...	...	...	...	...	...	17	
98. Affections of the Larynx :							
Laryngitis ...	...	...	...	...	...	1	
99. Bronchitis :							
(a) Acute ...	...	1	1	...	...	53	
(b) Chronic ...	...	...	...	...	...	1	
105. Asthma ...	...	...	...	...	...	5	
107. Other affections of the lungs ...	...	...	...	...	...	2	
Carried forward ...	1	56	57	2	3	248	

EUROPEAN—continued.

Diseases.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in Hospital at end of 1930.	Total Admission.	Total Cases treated.	Deaths.	Remaining in Hospital at end of 1931.	New Cases treated.	Subsequent Attendances.
Brought forward ...	1	56	57	2	3	248	
VI—DISEASES OF THE DIGESTIVE SYSTEM.							
108. A.—Diseases of the Teeth or Gums :							
Caries, pyorrhœa, etc. ...	...	...	...	...	...	9	
B.—Other Affections of the Mouth :							
Glossitis, etc. ...	1	1	2	...	...	...
109. Affections of the Pharynx or Tonsils :							
Tonsillitis ...	...	...	...	...	...	3	
Pharyngitis ...	...	...	...	...	...	20	
111. A.—Ulcer of the Stomach	...	1	1	...	...	...
112. Other Affections of the Stomach :							
Gastritis ...	...	...	...	...	...	13	
Dyspepsia, etc. ...	...	2	2	...	...	32	
114. Diarrhœa and Enteritis :							
Two years and over ...	...	...	...	...	...	27	
Colitis ...	...	...	...	...	...	1	
116. Diseases due to intes- tinal Parasites :							
(a) Cestoda (tænia) ...	...	...	...	...	...	3	
Ascaris ...	...	...	...	...	...	2	
117. Appendicitis ...	...	2	2	...	...	...
118. Hernia ...	...	2	2	...	...	1	
119. A.—Affections of the Anus, fistula, etc. ...	...	1	1	...	...	1	
B.—Other Affections of the Intestines :							
Constipation ...	...	...	...	...	...	40	
124. Other Affections of the liver :							
Hepatitis ...	...	...	...	...	...	1	
126. Peritonitis (of unknown cause) ...	...	1	1	1	...	...
127. Other Affections of the digestive system ...	...	...	...	...	...	4	
Carried forward ...	2	66	68	3	3	405	

EUROPEAN—continued.

Diseases.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in Hospital at end of 1930.	Total Admission.	Total Cases treated.	Deaths.	Remaining in Hospital at end of 1931.	New Cases treated.	Subsequent Attendances.
Brought forward ...	2	66	68	3	3	405	
VII—DISEASES OF THE GENITO-URINARY SYSTEM (NON-VENEREAL).							
128. Acute nephritis ...	..	...	...	...	...	1	
131. Other affections of the Kidneys :	...	2	2	...	...	1	
Pyelitis, etc. ...	...	1	1	...	...	...
Urinary calculus ...	...	1	1	...	...	1	
133. Diseases of the Bladder :							
Cystitis ...	...	1	1	...	...	8	
134. Diseases of the Urethra :							
(b) Other ...	...	...	...	...	...	2	
136. Other Diseases of the Male Genital Organs	...	...	...	...	...	1	
Ulcer of penis ...	...	...	...	...	...	1	
141. B.—Other Affections of the Female Genital Organs :	...	...	...	...	...	1	
Dysmenorrhœa ...	...	...	..	...	...	1	
VIII—PUERPERAL STATE.							
143. B.—Accidents of Pregnancy :							
(a) Abortion ...	...	1	1	...	...	...
IX—AFFECTIONS OF THE SKIN AND CELLULAR TISSUES.							
152. Boil : ...	...	1	1	...	...	12	
Carbuncle ...	...	4	4	...	...	1	
153. Abscess :	...	4	4	...	...	...
Whitlow ...	...	...	...	...	...	1	
Cellulitis ...	...	...	...	...	...	3	
154. A.—Tinea ...	...	...	...	...	...	7	
155. Other Diseases of the Skin :	...	...	...	...	...	16	
(c) Eczema ...	1	...	1	...	...	5	
(g) Myiasis ...	...	...	...	...	...	2	
(h) Chigoes ...	...	...	...	...	...	1	
(j) Ulcer ...	...	1	1	...	...	32	
X—DISEASES OF BONES AND ORGANS OF LOCOMOTION (OTHER THAN TUBERCULOUS.)							
156. Diseases of Bones—							
Osteitis ...	...	1	1	...	...	...
Carried forward ...	3	83	86	3	3	502	

EUROPEAN—continued.

Diseases.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in Hospital at end of 1930.	Total Admission.	Total Cases treated.	Deaths.	Remaining in Hospital at end of 1931.	New Cases treated.	Subsequent Attendances.
Brought forward ...	3	83	86	3	3	502	
X—DISEASES OF BONES AND ORGANS OF LOCO- MOTION (OTHER THAN TUBERCULOUS)— <i>contd.</i>							
157. Diseases of Joints :							
Arthritis ... ..	...	1	1	...	...	1	
Synovitis ... ..	...	...	...	...	...	2	
158. Other diseases of bones or organs of locomotion ...	...	...	...	...	...	8	
XIV—AFFECTIONS PRO- DUCED BY EXTERNAL CAUSES.							
175. Food poisoning :							
Botulism ... ..	..	...	...	...	...	1	
176. Attacks of poisonous Animals :							
Snake bite ... ..	...	...	...	...	...	2	
179. Burns (other than by fire) ... ..	...	1	1	...	...	1	
183. Wounds (by firearms, war excepted) ... ..	...	1	1	...	1	...	
164. Wounds (by cutting or stabbing instruments) ...	...	...	...	...	...	1	
185. Wounds (by fall) ...	...	...	...	...	...	1	
187. Wounds (by machi- nery) ... ..	...	...	...	...	...	1	
188. Wounds (crushing, e.g. railway accidents, etc.) ...	...	1	1	...	...	...
189. Injuries inflicted by animals, bites, kicks, etc. ...	...	...	...	...	...	2	
201.B. —Sprain ... ..	...	...	...	...	...	3	
C.—Fracture ... ..	...	1	1	..	1	...	
202. Other external injuries	...	2	2	...	...	22	
XV—ILL-DEFINED DISEASES.							
205. A.—Diseases not already specified or ill- defined :							
Ascites ... ..	...	1	1	...	...	...
Asthenia ... ..	...	..	...	...	...	54	
Total	3	91	94	3	5	601	

IV—RETURN OF DISEASES AND DEATHS—AFRICAN.

Diseases.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in Hospital at end of 1930.	Total Admission.	Total Cases treated.	Deaths.	Remaining in Hospital at end of 1931.	New Cases treated.	Subsequent Attendances.
I—EPIDEMIC, ENDEMIC AND INFECTIOUS DISEASES							
5. Malaria :							
(a) Tertian ...	...	2	2	...	...	...
(b) Quartan ...	...	4	4	...	...	9	
(c) Aestivo-autumnal ...	2	290	292	6	...	1,910	
(d) Cachexia ...	...	3	3	...	...	34	
(e) Blackwater ...	...	2	2	...	...	1	
(f) Unclassified ...	...	181	181	3	...	4,115	
6. Smallpox :	...	6	6	...	...	...
7. Measles ...	...	1	1	...	...	4	
9. Whooping Cough ...	...	2	2	...	...	102	
10. Diphtheria ...	...	2	2	1	...	...
11. Influenza ...	...	1	1	...	...	150	
13. Mumps ...	...	3	3	...	...	82	
16. Dysentery :							
(a) Amœbic ...	1	34	35	1	...	77	
(c) Undefined or due to other causes ...	...	24	24	7	...	194	
20. Leprosy ...	13	8	21	3	14	272	
21. Erysipelas ...	...	...	...	...	...	1	
24. Cerebro-spinal fever ...	...	1	1	1	...	...
25. Other Epidemic Di- scases:							
(b) Varicella (chicken- pox) ...	...	47	47	1	...	56	
(g) Yaws ...	11	53	64	2	11	7,385	
(h) Trypanosomiasis ...	...	4	4	2	...	1	
29. Tetanus ...	...	13	13	8	2	5	
31. Tuberculosis, pulmonary and laryngeal ...	3	46	49	14	2	99	
33. Tuberculosis of the intes- tines or peritoneum ...	...	4	4	...	...	4	
34. Tuberculosis of the verte- bral column ...	...	3	3	...	1	3	
35. Tuberculosis of bones and joints ...	1	3	4	...	...	1	
36. Tuberculosis of other Organs :							
(c) Lymphatic system ...	...	...	...	...	...	2	
(e) Other organs ...	...	1	1	...	...	...
38. Syphilis ...							
(a) Primary ...	...	6	6	...	...	76	
(b) Secondary ...	...	2	2	...	...	38	
(c) Tertiary ...	1	39	40	...	...	368	
(d) Hereditary ...	...	3	3	1	2	19	
(e) Period not indicated ...	...	4	4	...	...	36	
39. Soft chancre ...	...	23	23	...	...	140	
Carried forward ...	32	815	847	50	32	15,184	

The form shows in the main the arrangement of diseases in the International Nomenclature, 1921 Edition. To save space the unimportant diseases of any class can be grouped in their places as " Other Diseases " of the class.

AFRICAN—*continued.*

Diseases.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in Hospital at end of 1930.	Total Admission.	Total Cases treated.	Deaths.	Remaining in Hospital at end of 1931.	New Cases treated.	Subsequent Attendances.
Brought forward ...	32	815	847	50	32	15,184	
I—EPIDEMIC, ENDEMIC AND INFECTIOUS DISEASES, <i>continued.</i>							
40. A.—Gonorrhœa and its complications ...	3	83	86	...	8	2,090	
B.—Gonorrhœal oph- thalmia ...	...	15	15	...	...	32	
C.—Gonorrhœal arthri- tis ...	...	27	27	...	1	113	
41. Septicæmia ...	..	5	5	4	...	...
42. Other infectious diseases	...	2	2	...	...	...
II—GENERAL DISEASES NOT MENTIONED ABOVE.							
43. Cancer or other malig- nant tumours of the buccal cavity ...	...	...	...	...	...	4	
44. Cancer or other malig- nant tumours of the stomach or liver ...	...	2	2	1	...	2	
45. Cancer or other malig- nant tumours of the peritoneum, intestines, rectum ...	...	2	2	1	...	...
46. Cancer or other malig- nant tumours of the female genital organs	...	1	1	...	...	2	
47. Cancer or other malig- nant tumours of the breast ...	...	2	2	1	1	...	
48. Cancer or other malig- nant tumours of the skin ...	...	1	1	...	...	3	
49. Cancer or other malig- nant tumours of organs not specified	..	6	6	...	..	4	
50. Tumours, non-malignant	3	44	47	1	3	174	
51. Acute rheumatism ...	1	30	31	...	1	469	
52. Chronic rheumatism ...	2	53	55	2	6	5,018	
54. Pellagra ...	...	1	1	...	...	...
55. Beriberi ...	...	23	23	6	2	35	
56. Rickets ...	...	22	22	1	5	18	
57. Diabetes (not including insipidus) ...	...	...	...	...	...	3	
58. Anæmia :							
(a) Pernicious ...	...	1	1	...	...	..
(b) Other anæmias and chlorosis ...	1	11	12	4	...	562	
Carried forward ...	42	1,146	1,188	71	59	23,713	

AFRICAN—continued.

Diseases.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in Hospital at end of 1930.	Total Admission.	Total Cases treated.	Deaths.	Remaining in Hospital at end of 1931.	New Cases treated.	Subsequent Attendances.
Brought forward ...	42	1,146	1,188	71	95	23,713	
II—GENERAL DISEASES NOT MENTIONED ABOVE— <i>continued.</i>							
58a. Avitaminosis ...	...	20	20	1	6	58	
60. Diseases of Thyroid ...							
(a) Exophthalmic goitre ...	...	1	1	1	...	2	
(b) Other diseases of the thyroid gland, myxœdema ...	...	...	8	...	2	4	
64. Diseases of the spleen ...	...	8	3	1	...	428	
66. Alcoholism ...	1	2				1	
67. Chronic poisoning by mineral substances (lead, mercury, etc.) ...	...	...	9	2	...	1	
69. Other General Diseases	1	8				183	
III—AFFECTIONS OF THE NERVOUS SYSTEM AND ORGANS OF THE SENSES.							
71. Meningitis (not includ- ing tuberculous meningitis or cerebro- spinal meningitis) ...	...	1	1	1	...	7	
72. Locomotor ataxia ...	...	3	3	...	...	4	
73. Other affections of the spinal cord ...	...	1	1	...	1	1	
74. Apoplexy :							
(a) Hæmorrhage ...	...	3	3	2	...	12	
(c) Thrombosis ...	...	2	2	2	...	...
75. Paralysis :							
(a) Hemiplegia ...	6	25	31	9	5	92	
(b) Other paralysis ...	6	25	31	8	7	69	
76. General paralysis of the insane ...	...	1	1	1	...	...
77. Other forms of mental alienation ...	8	15	23	5	10	13	
78. Epilepsy ...	1	5	6	1	2	19	
79. Eclampsia, convul- sions, (non-puerperal) 5 years or over ...	...	...	...	...	...	2	
80. Infantile convulsions ...	...	6	6	5	...	21	
81. Chorea ...	...	1	1	...	...	...
82. A.—Hysteria ...	...	...	...	...	...	1	
B.—Neuritis ...	...	5	5	...	...	185	
C.—Neurasthenia ...	...	...	...	...	...	18	
84. Other affections of the nervous system, such as paralysis agitans ...	1	7	8	1	...	348	
Carried forward ...	66	1,285	1,351	111	92	25,182	

AFRICAN—*continued.*

Diseases.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in Hospital at end of 1930.	Total Admission.	Total Cases treated.	Deaths.	Remaining in Hospital at end of 1931.	New Cases treated.	Subsequent Attendances.
Brought forward ...	66	1,285	1,351	111	92	25,182	
III—AFFECTIONS OF THE NERVOUS SYSTEM AND ORGANS OF THE SENSES— <i>continued</i>							
85. Affections of the Organs of Vision :							
(a) Diseases of the eye ...	...	14	14	...	...	28	
(b) Conjunctivitis ...	...	28	28	...	1	921	
(d) Tumours of the eye ...	...	2	2	..	...	9	
(c) Other affections of the eye ...	1	5	6	1	3	389	
86. Affections of the ear or mastoid sinus ...	...	11	11	...	...	838	
IV—AFFECTIONS OF THE CIRCULATORY SYSTEM.							
87. Pericarditis ...	...	2	2	1	...	1	
88. Acute endocarditis, or myocarditis ...	...	1	1	..	...	2	
89. Angina pectoris ...	...	...	..	...	...	1	
90. Other Diseases of the Heart : ...	...	9	9	...	2	29	
(a) Valvular : ...	1	11	12	7	...	11	
Mitral ...	1	31	32	3	1	118	
Aortic ...	1	9	10	1	..	6	
(b) Myocarditis ...	1	4	5	1	1	...	
91. Diseases of the Arteries :							
(a) Aneurism ...	...	5	5	2	1	5	
(b) Arterio-sclerosis ...	...	...	...	...	...	15	
(c) Other diseases ...	..	...	...	...	...	1	
92. Embolism or thrombosis (non-cerebral) ...	...	...	...	...	...	1	
93. Diseases of the Veins :							
Hæmorrhoids ...	...	5	5	...	1	110	
Varicose veins ...	...	...	...	...	...	8	
Phlebitis ...	...	...	...	...	...	5	
94. Diseases of the Lympha- tic System :	...	1	1	...	1	4	
Lymphangitis ...	...	16	16	...	...	103	
Lymphadenitis, bubo (non-specific) ...	2	51	53	...	3	429	
95. Hæmorrhage of undeter- mined cause ...	...	2	2	...	...	3	
96. Other affections of the circulatory system ...	...	12	12	1	...	133	
Carried forward ...	73	1,504	1,577	128	106	28,352	

AFRICAN—continued.

Diseases	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in Hospital at end of 1930.	Total Admission.	Total Cases treated.	Deaths.	Remaining in Hospital at end of 1931.	New Cases treated.	Subsequent Attendances.
Brought forward ...	73	1,504	1,577	128	106	28,352	
V—AFFECTIONS OF THE RESPIRATORY SYSTEM.							
97. Diseases of the Nasal Passages ...	...	...	...	...	...	9	
Adenoids ...	...	1	1	...	...	4	
Polypus ...	...	...	...	...	...	1	
Rhinitis ...	...	...	...	...	...	62	
Coryza ...	...	7	7	...	...	860	
98. Affections of the Larynx :							
Laryngitis ...	...	1	1	...	1	156	
99. Bronchitis :							
(a) Acute ...	6	120	126	3	1	4,003	
(b) Chronic ...	2	25	27	1	...	4,185	
100. Broncho-pneumonia ...	...	44	44	12	3	43	
101. Pneumonia :							
(a) Lobar ...	2	51	53	13	3	22	
(b) Unclassified ...	...	60	60	12	3	59	
102. Pleurisy, Empyema ...	1	29	30	2	1	123	
103. Congestion of the Lungs ...	...	1	1	...	...	1	
105. Asthma ...	...	9	9	1	...	129	
107. Other affections of the Lungs ...	...	3	3	...	...	977	
Respiratory System ...	...	.	...	...	...	85	
VI—DISEASES OF THE DIGESTIVE SYSTEM.							
108. A.—Diseases of Teeth or Gums :							
Caries, Pyorrhœa, etc. ...	...	12	12	...	...	4,148	
B.—Other affections of the mouth :							
Stomatitis ...	...	3	3	...	...	223	
Glossitis, etc. ...	...	3	3	...	...	161	
109. Affections of the Pharynx or Tonsils :							
Tonsillitis ...	...	14	14	...	1	269	
Pharyngitis ...	...	7	7	...	...	150	
111. A.—Ulcer of the Stomach ...	...	1	1	1	...	...
B.—Ulcer of the Duodenum ...	...	1	1	...	...	...
112. Other affections of the Stomach :							
Gastritis ...	...	11	11	...	...	2	
Dyspepsia, etc. ...	...	8	8	...	1	370	
113. Diarrhœa and Enteritis :							
Under two years ...	...	4	4	2	...	3,453	
291							
Carried forward ...	84	1,919	2,003	175	120	48,138	

AFRICAN—continued.

Diseases.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in Hospital at end of 1930.	Total Admission.	Total Cases treated.	Deaths.	Remaining in Hospital at end of 1931.	New Cases treated.	Subsequent Attendances
Brought forward ...	84	1,919	2,003	175	120	48,138	
VI—DISEASES OF THE DIGESTIVE SYSTEM, <i>continued.</i>							
114. Diarrhœa and Enteritis :							
Two years and over	2	55	57	7	...	874	
Colitis ...	...	13	13	...	...	13	
115. Ankylostomiasis ...	...	21	21	...	...	63	
116. Diseases due to Intestinal Parasites :							
(a) Cestoda (tænia)	...	4	4	...	...	614	
(b) Trematoda (flukes)	...	...	...	...	...	1	
(c) Nematoda (other than ankylostoma)—	...	...	...	..	...	1	
Ascaris ...	...	16	16	...	...	3,358	
Strongylus ...	...	1	1	...	...	2	
Oxyuris ...	...	...	...	...	...	7	
(f) Unclassified ...	...	..	...	...	...	1	
117. Appendicitis ...	...	4	4	..	...	1	
118. Hernia ...	14	233	247	11	20	229	
119. A.—Affections of the anus, fistula, etc. ...	...	14	14	...	3	13	
B.—Other Affections of the Intestines :	...	...	...	...	...	20	
Constipation ...	...	21	21	...	...	9,192	
122. Cirrhosis of the Liver :							
(a) Alcoholic ...	...	1	1	1	...	...
(b) Other forms ...	...	10	10	3	...	1	
124. Other Affections of the Liver :							
Abscess ...	...	5	5	1	...	22	
Hepatitis ...	...	16	16	1	...	53	
Cholecystitis ...	...	4	4	...	...	1	
Jaundice ...	..	3	3	...	...	20	
125. Diseases of the pancreas	...	1	1	...	...	...
126. Peritonitis (of unknown cause) ...	...	2	2	2	...	3	
127. Other affections of the digestive system ...	...	21	21	1	...	448	
VII—DISEASES OF THE GENITO-URINARY SYSTEM (NON-VENEREAL).							
128. Acute nephritis ...	...	18	18	3	1	76	
129. Chronic ...	...	21	21	6	...	70	
Carried forward ...	100	2,403	2,503	211	144	63,221	

AFRICAN—continued.

Diseases.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in Hospital at end of 1930.	Total Admission.	Total Cases treated.	Deaths.	Remaining in Hospital at end of 1931.	New Cases treated.	Subsequen Attendances
Brought forward ...	100	2,403	2,503	211	144	63,221	
VII—DISEASES OF THE GENITO-URINARY SYSTEM (NON-VENEREAL)— <i>contd.</i>							
130. B.—Schistosomiasis ...	...	5	5	...	...	12	
131. Other Affection of the Kidneys :	...	10	10	2	2	60	
Pyelitis, etc. ...	...	2	2	...	...	9	
132. Urinary calculus ...	...	2	2	1	...	...
133. Diseases of the Bladder :							
Cystitis ...	...	6	6	...	...	90	
134. Diseases of the Urethra :							
(a) Stricture ...	...	47	47	3	4	82	
(b) Other ...	1	17	18	...	2	76	
135. Diseases of the Prostate :							
Prostatitis ...	...	1	1	...	...	2	
136. Other Diseases of the Male Genital Organs	2	28	30	1	...	63	
Epididymitis ...	...	5	5	...	...	35	
Orchitis ...	...	26	26	...	4	182	
Hydrocele ...	2	61	63	...	4	142	
Ulcer of penis ...	...	9	9	...	...	100	
137. Cysts or other non-malignant tumours of the ovaries ...	...	3	3	...	...	7	
138. Salpingitis ...	...	26	26	...	...	6	
139. Uterine tumours (non-malignant) ...	...	28	28	2	...	46	
140. Uterine hæmorrhage (non-puerperal) ...	...	7	7	...	...	16	
141. A.—Metritis ...	...	15	15	...	...	79	
B.—Other affections of the female genital organs :	...	10	10	...	1	345	
Displacements of uterus ...	...	4	4	...	...	17	
Amenorrhœa ...	...	6	6	...	...	698	
Dysmenorrhœa ...	...	15	15	...	...	312	
Leucorrhœa ...	...	6	6	...	...	122	
142. Diseases of the Breast (Non-puerperal) :							
Mastitis ...	...	18	18	1	2	60	
Abscess of breast ...	...	2	2	...	...	21	
Carried forward ...	105	2,762	2,867	221	163	65,803	

AFRICAN—*continued.*

Diseases.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in hospital at end of 1930.	Total Admission.	Total Cases treated.	Deaths.	Remaining in Hospital at end of 1931.	New Cases treated.	Subsequent Attendances.
Brought forward ...	105	2,762	2,867	221	163	65,803	
VIII—PUERPERAL STATE.							
143. A.—Normal labour ...	3	265	268	...	4	11	
B.—Accidents of Pregnancy :							
(a) Abortion ...	1	46	47	1	1	92	
(c) Other accidents of pregnancy ...	1	2	3	2	...	52	
(d) Other complications of pregnancy ...	...	155	155	...	...	18	
144. Puerperal hæmorrhage ...	...	1	1	...	...	2	
145. Other accidents of parturition ...	...	67	67	4	...	3	
146. Puerperal septicaemia ...	...	1	1	...	...	...
148. Puerperal eclampsia ...	...	2	2	...	...	...
149. Sequelæ of labour ...	...	4	4	...	...	19	
150. Puerperal affections of the breast ...	...	2	2	...	...	7	
IX—AFFECTIONS OF THE SKIN AND CELLULAR TISSUES.							
151. Gangrene ...	...	2	2	...	...	...
152. Boil—	...	15	5	...	...	309	
Carbuncle ...	...	14	14	...	1	185	
153. Abscess—	3	124	127	2	5	381	
Whitlow ...	...	35	35	...	2	410	
Cellulitis ...	1	80	81	1	2	428	
154. A.—Tinea ...	...	...	...	...	...	376	
B.—Scabies ...	...	3	3	...	...	758	
155. Other Diseases of the Skin—	...	6	6	...	...	579	
(a) Erythema ...	...	...	...	...	...	6	
(b) Urticaria ...	...	1	1	...	...	11	
(c) Eczema ...	...	6	6	...	...	416	
(d) Herpes ...	...	1	1	...	...	36	
(e) Psoriasis ...	...	1	1	...	...	7	
(f) Elephantiasis ...	4	66	70	1	5	120	
(g) Myiasis ...	...	...	...	...	...	...
(h) Chigoes ...	1	1	2	...	1	25	
(j) Ulcer ...	29	358	387	15	34	7,080	
Carried forward ...	148	4,010	4,158	247	218	77,134	

AFRICAN—continued.

Diseases.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in Hospital at end of 1930.	Total Admission.	Total Cases treated.	Deaths.	Remaining in Hospital at end of 1931.	New Cases treated.	Subsequent Attendances.
Brought forward ...	148	4,010	4,158	247	218	77,134	
X—DISEASES OF BONES AND ORGANS OF LOCO- MOTION (OTHER THAN TUBERCULOUS).							
156. Diseases of Bones :							
Osteitis ...	...	8	8	...	...	321	
157. Diseases of Joints :							
Arthritis ...	2	42	44	1	4	1,387	
Synovitis ...	...	17	17	...	2	159	
158. Other diseases of bones or organs of locomotion	...	28	28	2	1	2,159	
XI—MALFORMATIONS.							
159. Malformations :	...	2	2	...	...	2	
XII—DISEASES OF INFANCY.							
160. Congenital debility ...	...	1	1	1	...	6	
161. Premature birth ...	...	4	4	2	...	1	
162. Other affections of infancy ...	...	2	2	...	...	5	
163. Infant neglect (infants of three months or over)	...	1	1	1	...	8	
XIII—AFFECTIONS OF OLD AGE.							
164. Senility :	1	9	10	6	...	5	
XIV—AFFECTIONS PRODUCED BY EXTERNAL CAUSES.							
166. Corrosive poisoning (intentional) ...	...	1	1	1	...	...
167. Other poisonings ...	...	1	1	...	...	...
171. Suicide by cutting or stabbing instruments	...	1	1	...	...	...
176. Attacks of Poisonous Animals :							
Snake bite ...	...	5	5	...	...	23	
Insect bite ...	...	1	1	...	...	97	
177. Other accidental poisonings ...	...	...	...	...	...	2	
178. Burns (by fire) ...	1	26	27	3	...	96	
179. Burns (other than by fire) ...	...	3	3	...	...	91	
180. Suffocation (acciden- tal) ...	...	...	...	...	...	2	
Carried forward ...	152	4,162	4,314	264	225	81,498	

AFRICAN—continued.

Diseases.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in Hospital at end of 1930.	Total Admission.	Total Cases treated.	Deaths.	Remaining in Hospital at end of 1931.	New Cases treated.	Subsequent Attendances.
Brought forward ...	152	4,162	4,314	264	225	81,498	
XIV—AFFECTIONS PRODUCED BY EXTERNAL CAUSES— <i>contd.</i>							
181. Poisoning by gas accidental) ...	...	...	...	...	...	1	
182. Drowning (accidental)	...	1	1	...	...	2	
183. Wounds (by firearms, war excepted) ...	...	9	9	...	1	18	
184. Wounds (by cutting or stabbing instruments)	...	52	52	...	2	1,000	
185. Wounds (by fall) ...	...	50	50	3	1	363	
186. Wounds (in mines or quarries) ...	...	...	...	...	...	2	
187. Wounds (by machi- nery) ...	...	5	5	...	...	6	
188. Wounds (crushing, e.g. railway accidents, etc.)	...	...	...	...	...	38	
189. Injuries inflicted by animals, bites, kicks, etc. ...	1	17	18	2	...	161	
190. Wounds inflicted on active service ...	...	1	1	...	...	25	
192. A.—Overfatigue ...	...	...	...	...	...	6	
B.—Hunger or thirst	...	3	3	1	...	1	
193. Exposure to cold, frostbite, etc. ...	...	4	4	2	...	...
194. Exposure to Heat :						5	
Heat stroke ...	...	1	1	1	...	...
Sun stroke ...	...	...	...	...	...	...
195. Lightning stroke ...	...	...	...	...	...	1	
196. Electric shock ...	...	1	1	...	...	...
201. A.—Dislocation ...	1	16	17	1	1	32	
B.—Sprain ...	...	16	16	...	...	469	
C.—Fracture ...	2	72	74	8	9	73	
202. Other external injuries	4	113	117	1	5	4,256	
XV—ILL-DEFINED DISEASES.							
205. A.—Diseases not al- ready specified or ill-defined							
Ascites ...	1	10	11	1	1	66	
Edema ...	1	16	17	...	1	216	
Asthenia ...	12	18	30	13	7	754	
Shock ...	...	1	1	...	...	19	
Hyper-pyrexia ...	...	1	1	...	...	1	
B.—Malingering ...	...	...	...	...	...	15	
Pyrexia of uncertain origin ...	29	...	29	...	...	190	
No appreciable diseases	1	...	1	..	...	67	
Undiagnosed ...	...	2	2	...	...	9	
Total ...	204	4,571	4,775	297	253	89,289	

Appendices.

A—REPORT OF THE SURGICAL SPECIALIST, CONNAUGHT HOSPITAL.

There were no changes of importance in the running of the surgical clinic. I was on leave during the year and the figures are somewhat less than in 1930.

Owing to the necessity for economy it was not possible to branch out in any new direction or to obtain all that could be desired in the way of equipment.

I append below details of operative work.

Q. STEWART,
Surgical Specialist.

OPERATIONS AT THE CONNAUGHT HOSPITAL IN 1931.

				Cured.	Relieved.	Unrelieved.	Died
(1) Abdominal:							
Herniotomy—epigastric	...	...		1	—	—	—
Herniotomy—inguinal	...	...		196	—	—	2
Herniotomy—femoral	...	...		6	—	—	—
Herniotomy—strangulated inguinal	...	...		4	—	—	3
Enterostomy	...	...	...	1	—	—	—
Enterectomy	...	...	...	2	—	—	—
Appendicectomy	...	...	...	3	—	—	—
Ileo-colectomy	...	...	...	2	—	—	—
Exploratory laparotomy	...	...	...	—	—	4	1
Aspiration of liver for liver abscess	...	...	...	3	—	—	—
Open drainage of liver for abscess	...	...	...	—	—	—	1
Aspiration of ascites	...	...	...	—	5	—	—
(2) Ano-Rectal:							
Excision of fistula in ano	...	...	...	7	—	—	—
Excision of hæmorrhoids	...	...	...	4	—	—	—
Injection of hæmorrhoids	...	...	...	1	—	—	—
Injection of fissure	...	...	...	1	—	—	—
Dilatation of rectal stricture	...	...	...	—	4	—	—
Opening of imperforate anus	...	...	...	—	—	—	2
(3) Ear, Nose and Throat:							
Excision of goundou	...	...	...	2	—	—	—
Drainage of septic sinuses	...	...	...	3	—	—	—
Enucleation of tonsils	...	...	...	2	—	—	—
Curettage of adenoids	...	...	...	1	—	—	—
Tracheotomy	...	...	...	—	—	—	1
(4) Eyes:							
Extraction of cataract	...	...	...	4	—	—	—
Iridectomy	...	...	...	1	—	—	—
Excision of eye ball	...	...	...	1	—	—	—
(5) Genito-Urinary (Male):							
Cystoscopy	...	...	...	—	—	8	—
Excision of scrotum for elephantiasis	...	...	...	28	—	—	—
Excision of hypertrophied scrotum	...	...	...	6	—	—	1
Radical cure of hydrocele	...	...	...	80	—	—	—
Tapping and injection of hydrocele	...	...	...	28	—	—	—
Tapping of hydrocele	...	...	...	—	6	—	—
Suprapubic puncture of bladder	...	...	...	—	1	—	—
Suprapubic cystostomy for drainage of bladder	...	...	...	3	—	—	1
Drainage for extravasation	...	...	...	5	—	—	—
Dilatation of stricture	...	...	...	—	143	—	—
Catheterisation	...	...	...	—	7	—	1
Excision of urethral sinuses	...	...	...	—	3	1	—
Excision of penile elephantiasis	...	...	...	3	—	—	—
Plastic operation for penile deformity	...	...	...	1	—	—	—
Urethrotomy	...	...	...	—	1	—	—
Circumcision	...	...	...	7	—	—	—
For varicocele	...	...	...	1	—	—	—
Orchidectomy	...	...	...	11	—	—	—
Nephrectomy	...	...	...	2	—	—	—

				Cured.	Relieved.	Unrelieved.	Died.
(6) <i>Gynaecological</i> :							
Hysterectomy	...	...	...	10	—	—	2
Myomectomy	...	...	...	1	—	—	1
Curettage	...	...	...	3	—	—	—
Colpotomy	...	...	...	—	—	—	1
Excision of vulval elephantiasis	...	...	...	1	—	—	—
Gilliam's operation for retro-flexion	...	...	...	3	—	—	—
Excision of broad ligament cyst	...	...	...	3	—	—	—
Excision of ovarian cyst	...	...	...	1	—	—	—
Cauterisation of cervix	...	...	...	4	—	—	—
Trachelorrhaphy	...	...	...	1	—	—	—
Opening of imperforate vagina	...	...	...	1	—	—	—
Excision of cyst of breast	...	...	...	1	—	—	—
Excision of duct papilloma of breast	...	...	...	1	—	—	—
Excision of breast for carcinoma	...	...	...	—	1	—	—
(7) <i>Head and Neck</i> :							
Excision of epulis of jaw	...	...	...	1	—	—	1
Excision of mixed salivary tumours	...	...	...	2	—	—	—
Excision of epithelioma tongue	...	...	...	—	1	—	—
Thyroidectomy for goitre	...	...	...	—	—	—	1
Intracranial decompression	...	...	...	—	—	—	1
(8) <i>Miscellaneous</i> :—							
Drainage of septic conditions	...	...	...	212	—	—	2
Excision of glands	...	...	...	1	—	—	—
Suture of wounds	...	...	...	251	—	—	—
Aspiration of pleura	...	...	...	3	—	—	—
Drainage empyema	...	...	...	1	—	—	—
Extraction of teeth	...	...	...	62	—	—	—
Excision of cysts	...	...	...	12	—	—	—
Ligature of innominate and common carotid for sub-clavian aneurism	...	...	...	—	—	—	1
Ligature middle meningeal for haemorrhage	...	...	...	1	—	—	—
Blood transfusion	...	...	...	—	1	—	—
(9) <i>Orthopaedics</i> :—							
Reduction of simple fractures and separated epiphyses	...	...	...	42	—	—	—
Reduction of compound fractures	...	...	...	5	—	—	1
Reduction of dislocations	...	...	...	7	—	—	—
Open operation for							
(a) separated epiphysis	...	...	...	1	—	—	—
(b) wiring patellar fracture	...	...	...	1	—	—	—
Extension of fractures by means of pins	...	...	...	8	—	—	—
Excision of fibro-cystic tumour femur	...	...	...	—	1	—	—
Drainage and sequestrectomy for osteomyelitis	...	...	...	12	—	—	—
Laminectomy	...	...	...	—	—	—	1
Drainage of arthritis	...	...	...	2	—	—	—
Aspiration of joints	...	...	...	—	4	—	—
Breaking down of adhesions in joints	...	...	...	—	3	—	—
Tendon suture	...	...	...	1	—	—	—
Amputation of leg	...	...	...	4	—	—	—
„ toe	...	...	...	16	—	—	—
„ arm	...	...	...	—	—	—	2
„ finger	...	...	...	8	—	—	—
Excision of scar contracture	...	...	...	1	—	—	—
Plaster cases	...	...	...	—	17	—	—
(10) <i>Skin and Subcutaneous Tissues</i> :							
Excision of epitheliomata	...	...	...	1	—	—	—
Excision of sinuses	...	...	...	2	2	—	—
Excision of ulcers	...	...	...	7	—	—	—
Excision of elephantiasis leg	...	...	...	—	2	—	—
Skin grafting	...	...	...	8	—	—	—
Removal of foreign bodies	...	...	...	18	—	—	—
Debridement of burns	...	...	...	1	—	—	—
Excision of non-malignant tumours	...	...	...	16	—	—	—
Total				1,157	202	13	27

NOTE.—Dilatations of stricture of the urethra are placed under the heading “Relieved” in all cases.

OPERATIONS PERFORMED ON EUROPEANS.

				Cured.	Relieved.	Unrelieved.	Died.
Herniotomy inguinal	...	...	...	1	1	—	—
Appendicectomy	...	...	...	1	—	—	—
Laparotomy	...	...	...	—	—	—	1
Excision of fistula in ano	...	...	...	1	—	—	—
Suture of wounds	...	...	...	1	—	—	—
Excision of cyst	...	...	...	1	—	—	—
Drainage of septic conditions	...	...	...	2	—	—	—
Cystoscopic examination	...	...	...	—	—	1	—
Sigmoidoscopic examination	...	...	...	—	—	1	—
Total				7	1	2	1

Percentage of Deaths	...	...	...	1·9
Number of Operations in 1926	...	...	...	29
Number of Operations in 1927	...	...	...	257
Number of Operations in 1928	...	...	...	755
Number of Operations in 1929	...	...	...	761
Number of Operations in 1930	...	...	...	1,566
Number of Operations in 1931	...	...	...	1,410

Anaesthetics.

Spinal	...	...	...	...	...	406
Ethyl chloride	...	...	...	...	...	108
Chloroform	...	...	...	...	...	160
Local	...	...	...	...	...	101
Colonic ether	...	...	...	...	...	3
Total				...	...	778

B—MATERNITY WARD.—CONNAUGHT HOSPITAL.

This ward contains twelve beds; ten are in the open ward and two in a separate labour room.

The total number of admissions to this ward including Ante-Natal cases was 357. Of this number 251 gave birth to 259 children there being eight twin labours. Of the 251 labour cases ninety-eight were primiparae; sixty-five of the total labour cases were abnormal, the twin cases being included together with twenty-eight cases in which the only abnormality was a torn perinaeum.

For the purpose of this report every case has been given a number and the table appended shows the features which rendered each case abnormal—those due to torn perinaeum alone have not been included in this list.

There were five maternal deaths:—

Case 235. Twins: Sapræmia: Hyperpyrexia—died on 9th day.

Case 220. Admitted with enteritis: collapse on 9th day of puerperium, following normal delivery.

Case 115. Neglected shoulder presentation—sent in moribound.

Case 94. Impacted Breech sent in after prolong labour and repeated attempts at extraction under general anaesthesia. Embryotomy performed—patient collapsed on 3rd day of puerperium.

Case 35. Premature rupture of membranes: forceps extraction living child. Mother died of lobar pneumonia on the tenth day of puerperium.

There were thirteen children dead born, four still born and ten died after birth. The special feature associated with each can be seen on reference to table.

MATERNITY WARD TABLE OF ABNORMALITY 1931.

Embryotomy.	Craniotomy.	Ante Partum Hæmorrhage.	Dead Born.	Still Born.	Baby Died.	Premature.	Forceps.	Breach.	Twins.	Maternal Death.	Hydrarniocs Spinal Bifida.	Eclampsia.	Prolapse Cord.	Shoulder.	Maternal Pyrexia.	Hæmatobia Labia.	Septicæmia.	Pneumonia.
			248			248												
			245		236(1)	245	216	235(1)	236	235						238		
			216	202		199		195				216						
			205		189 164(1)	189	135		164									
	64		115		116	116		145		115				115				116
		93	94				104	133(1)	133									
94			91				94	94	111	94								
			64				64	93(1)	93									
						49	54											
			33			49		40			40							
			25			38		41										
			23	26		33	35								38			
			13															
			2 (1)			21	13 10	26	10 2	35			13				35	35

There were 106 complicated pregnancies admitted for the following reasons:—

Observation	...	...	...	...	...	34
Admitted during puerperium	...	...	...	...	...	6
False pains	...	...	...	...	...	11
Anæmia	...	...	...	...	...	1
Clinical Malaria	...	...	...	...	...	4
M. T. Malaria	...	...	...	...	...	8
B. T. Malaria	...	...	...	...	...	1
Pyrexia	...	...	...	...	...	2
Bronchitis	...	...	...	...	...	2
Cardiac Disease	...	...	...	...	...	1
Deficiency Disease	...	...	...	...	...	8
Amœbic Dysentery	...	...	...	...	...	3
Threatened Abortion	...	...	...	...	...	3
Abortion (Incomplete)	...	...	...	...	...	3
Abortion (Complete)	...	...	...	...	...	1
Miscarriage (Incomplete)	...	...	...	...	...	1
Miscarriage (Complete)	...	...	...	...	...	3
Hyperemesis Gravidarum	...	...	...	...	...	1
Hæmaturia	...	...	...	...	...	1
Albuminuria	...	...	...	...	...	3
Ante partum Eclampsia	...	...	...	...	...	1
Vaginitis	...	...	...	...	...	1
Oedema Legs	...	...	...	...	...	6
Cellulitis Leg	...	...	...	...	...	1
Total						106

E. J. WRIGHT,
Medical Officer.

C—REPORT ON INFANT WELFARE.

(a) CONNAUGHT HOSPITAL AND CAMPBELL STREET.

These Clinics were held as in previous years at centres situated at 99, Campbell Street and the Connaught Hospital. The former serving the West Ward and the latter the Central Ward. The East Ward of the town is served by the Princess Christian Mission Hospital, and is not dealt with in this particular report.

All patients attending these clinics are treated free of charge whatever their status, as it is considered in the interest of the public health that the use of these clinics should be encouraged. There were 722 new individuals under the age of three years admitted to these two clinics during the year. Table I shows the ages at which the children were first brought.

TABLE I.

Under 1 week	...	...	...	...	...	1
„ 2 weeks	...	...	...	...	...	30
„ 1 month	...	...	...	...	...	128
1—3 months	...	...	...	...	...	158
3—6 months	...	...	...	...	...	125
6—12 months	...	...	...	...	...	105
1—2 years	...	...	...	...	...	107
2—3 years	...	...	...	...	...	68
Total						722

Of this number 571 were under the age of one year on their first attendance. Although these 571 children were not all necessarily born during the year, they were all candidates for swelling the infant mortality rate for the year. In order to find out if these clinics have a real beneficial effect and are serving the purpose for which they were started, it is necessary to have very accurate records of names, ages, residences, etc., on the date of first admission to the clinic and also to avoid double entries in the register through change of name, address, etc., as the child ages. Such a register has been kept and carefully scrutinized from time to time so that now at the end of the year a statement can be made about the deaths among these children. The number of infantile deaths registered in the Freetown district, (not including Cline Town) was 319 and a careful comparison with the register of deaths shows that there were only nine out of these 319 registered deaths among the 571 children above mentioned.

Deaths among the older children, i.e., one to two years and two to three years cannot affect the Infant Mortality rate, nevertheless it is interesting and of importance to know what is happening to them at the clinics. From the same statistics it is possible to say that although forty deaths were registered as occurring among children over one year and up to two years, there was only one death among children in this age group who attended the clinics, and similarly out of twenty-five deaths registered between two and three years of age there was only one death among clinic children to be found in the Registrars's record.

Out of 319 infantile deaths registered for Freetown (not including Cline Town), fifty-two did not survive birth twenty-four hours. From this it is apparent that fifty-two children died who were beyond the reach of the Infant Welfare Clinics; but the remaining 267 were over two weeks old and might have been brought to the clinics for observation and treatment. The very low death rate among the clinic children and high death rate among the non-attendants suggest that at least a very large number of the 267 non-attendants who died could have been saved had they sought the help available to them.

The Ante-natal Clinic and Maternity department is more competent to tackle the very early Infant Mortality referred to previously but little will be possible until an out-door midwifery service can be formed.

It is expected that the vacant post of Senior Health Visitor will be filled this year.

I have expressed the view that these very early infantile deaths are due to congenital debility the result of maternal deficient diet. In 1925, syphilis and maternal malaria were eliminated as serious sources of very early infantile deaths in Freetown. A recent investigation by Butler and Summerhayes on the Gold Coast helps to support this view in as much as they found that maternal malaria does not prejudice the chance of the child surviving, nor could they incriminate syphilis, two factors persistently blamed for very early infantile deaths in the absence of sufficient evidence. The extraordinary prevalence of A—avitaminosis among pregnant women apparent by the conditions of mouth, tongue, eyes and skin is sufficient evidence of the dietetic deficiency and maternal depletion that goes on during pregnancy. The liberal use of Oleum Morrheae and vitamin A concentrated with Marmite is very helpful but cannot make up for the ill-feeding from which these women suffer through ignorance and poverty.

The following table shows the number of monthly attendances at each clinic during the year.

TABLE II.
INFANT WELFARE CLINIC RECORD OF ATTENDANCES
JANUARY TO DECEMBER, 1931.

Connaught Hospital.				Campbell Street.			
Date.	Old Cases.	New Cases.	Total.	Date.	Old Cases.	New Cases.	Total.
January ...	257	45	302	January ...	259	48	307
February ...	204	27	231	February ...	289	24	313
March ...	212	27	239	March ...	310	35	345
April ...	178	26	204	April ...	226	21	247
May ...	233	20	253	May ...	261	32	293
June ...	264	31	295	June ..	296	34	330
July ...	279	43	322	July ...	268	30	298
August ...	244	34	278	August ...	340	55	395
September ...	337	39	376	September ...	346	33	379
October ...	463	38	501	October ...	444	31	475
November ...	376	38	414	November ...	569	22	591
December ...	179	11	190	December ...	232	23	255
Total ...	3,226	379	3,605	Total ...	3,840	388	4,228

Total new individuals ... 767. Total attendances ... 7,066.

This table, compiled from month to month contains 45 more new individuals than actually attended, as it was only possible to eliminate double entries on surveying the complete year's work.

The total number of new cases for the year was 722.

This number includes 69 villagers as follows:—

Murray Town	...	...	...	...	19
Wilberforce	...	...	...	...	17
Kissy	...	...	...	...	11
Aberdeen	...	...	...	...	5
Lumley	...	...	...	...	4
Regent	...	...	...	...	4
Leicester	...	...	...	...	3
Goderich	...	...	...	...	2
Gloucester	...	...	...	...	2
Hastings	...	...	...	...	1
Hamilton	...	...	...	..	1

The total number of attendances for the year was 7,066.

The next table shows the visits paid by the District Nurse month by month during the year.

TABLE III.

INFANT WELFARE—RECORD OF VISITS BY DISTRICT HEALTH VISITOR—JANUARY TO DECEMBER, 1931.

Date.		Newly Born.	New Cases.	Repeated Visits.
January	...	59	43	263
February	..	44	59	172
March	...	56	68	206
April	...	40	48	286
May	...	46	29	200
June	...	39	51	296
July	...	44	71	214
August	...	46	35	188
September	...	36	15	195
October	...	42	39	258
November	...	53	45	216
December	...	38	29	129
Total	...	543	532	2,723

There were 1,263 births registered in the Freetown area and 363 infantile deaths (i.e., under 12 months) which gives an infant mortality rate of 288 for Freetown for the year.

The Infant Mortality for the last five years is as follows.—

Year.	Births Registered.	Deaths under 12 months.	Infant Mortality Rate.
1927	1,010	355	351
1928	1,036	377	364
1929	1,093	349	319
1930	1,102	371	339
1931	1,263	365	288

E. J. WRIGHT,
Medical Officer.

(b) PRINCESS CHRISTIAN MISSION HOSPITAL.

The following table gives the total of all visits paid by the Health Visitor in 1931. It will be observed that the gross figure of 4,447 compares very favourably with that of 3,995 in 1930.

Months.				Number of visits paid to New-born babies.	Number of Return Visits.
January	...	...	...	64	364
February	...	...	...	45	384
March	...	...	...	41	382
April	...	...	...	34	359
May	...	...	...	41	411
June	...	...	...	47	381
July	...	...	...	47	304
August	...	..	...	50	338
September	...	...	...	51	338
October	...	...	..	38	238
November	...	...	...	33	254
December	...	...	...	18	195
Total	...	...	...	509	3,948

D—THE INCIDENCE AND DISTRIBUTION OF MALARIA AMONGST INFANTS AND SCHOOL CHILDREN IN FREETOWN.

BY

R. M. GORDON & T. H. DAVEY.

(From the Sir A. L. Jones Research Laboratory.)

The facts which follow represent, in the main a summary of a paper recently published in the Annals of Tropical Medicine and Parasitology.

THE INCIDENCE OF MALARIA IN FREETOWN.

An examination of the literature shows that the figures available regarding the general incidence of malaria amongst children in Freetown, demonstrate an infection rate varying from twenty to sixty per cent. Our 1931 examination has shown no striking change; of one thousand seven hundred and ninety four children under the age of sixteen years, whose blood was taken, seven hundred and ninety four (44.3 per cent.) showed malaria parasites.

The distribution of the three species of malaria parasites amongst these seven hundred and ninety four positives was as follows. *P. falciparum* 39.6 per cent; *P. malariae* 42.5 per cent; *P. vivax* 1.3 per cent; mixed infections 16.5 per cent; while in eight cases it was not found possible to identify the species. On re-distributing the mixed infections we arrive at the following results:—

P. falciparum 56.6 per cent; *P. malariae* 59.5 per cent; *P. vivax* 0.5 per cent. This preponderance of the quartan parasite is far in excess of any figures previously quoted for Freetown and justifies the use of the term "Quartan epidemic". The highest figure heretofore recorded is that of Dalziel and Johnston (1915), who among two hundred and twenty-one positive cases found *P. malariae* in 21.9 per cent.

That this increase in quartan infection is not confined to native children is shown by the fact that during 1931 amongst thirty five Europeans, in whose blood malaria parasites were found, seven were found to be infected with quartan malaria, a disease previously almost unknown amongst Europeans in Freetown.

THE SEASONAL VARIATION IN THE PARASITE AND GAMETOCYTE RATES.

As the examination of school children was carried out during an entire year it was possible to estimate the monthly incidence of infection. In February and March the parasite rate was found to be at its lowest—26 to 28 per cent. and from then steadily increased, reaching a maximum of 71.7 per cent. in January. The gametocyte rate (i.e., crescents and quartan gametocytes) was at its lowest in March, being then only 4 per cent. This was followed by a steady rise, always 20 to 25 per cent. below the parasite rate up to its highest point 35 per cent., in October when it fell rapidly to 19 per cent., although the parasite rate continued to rise. These variations are shown below in Table I.

TABLE I.

Showing the monthly variation in the parasite and gametocyte rates amongst one thousand four hundred and forty six African children, aged four to sixteen, attending the schools in Freetown.

Month.	Number examined.	Number positive.	Percent positive.	Number with M.T.	Number with Q.	Number with mixed M.T. and Q.	Number with cre-scents.	Number with Q. gameto-cytes.	Percentage of total examined, showing M. T. or Q. game-tocytes.
February, 1931 ¹	133	37	28	22	15	—	12	5	12·8
March ¹ ...	77	20	26	9	11	—	2	1	3·9
April ¹ ...	—	—	—	—	—	—	—	—	—
May ...	136	50	37	23	23	4	9	1	7·3
June ...	199	78	39	23	45	10	11	13	12·1
July ...	155	57	37	21	31	4	13	10	14·8
August ...	139	57	41	33	18	4	27	6	23·8
September ...	104	52	50	16	31	5	15	11	25·0
October	104	57	54	14	24	19	23	13	34·6
November	148	68	46	13	34	20	10	17	18·6
December ...	106	71	67	23	24	23	13	8	19·6
January, 1932 ²	145	104	72	34	43	26	8	12	13·6
Year ...	1,446	651	45	231	299	115	143	97	16·6

AGE INCIDENCE OF MALARIA IN FREETOWN.

With regard to the age incidence of malaria in Freetown, Blacklock and Gordon (1925) have shown that in children the infection rate rises very rapidly from the age of one to eighteen months, and at this age remains almost constant at about 40 per cent. until the age of two-and-a-half years where their observations ceased. MacDonald's (1926) figures for the endemic area of Freetown, show that this incidence is maintained approximately at the same level up to the age of twelve to fourteen years. The results obtained by us in 1931 follow closely the two earlier observations until the age of ten years when in our figures a steady decline occurs in the parasite rate from 40 per cent. to 13·5 per cent. at sixteen years. Further analysis of the 1931 results shows that in the earlier age groups, up to four years, malignant tertian malaria is the more common infection but from that time quartan infections predominate until the age of nine, when the two species assume approximately equal proportions and their incidence decreases at a similar rate. No explanation is offered for the curious fact that in Freetown children of five to nine years show a higher incidence of quartan malaria than those in other age periods.

THE DISTRIBUTION OF MALARIA IN FREETOWN.

A note of the address of each child was made at the time of examination, and charted on a large scale town map; in this way it was possible to estimate the incidence of malaria in any locality. In an article of the present type it is impossible to deal fully with the mass of information thus collected. It can be stated, however, that malaria is more prevalent in the western than in the central or eastern portions of the town, thus corroborating MacDonald's observations in 1926.

The percentages of children infected with malaria in the different schools were found to be as follows:—

School.	Number examined.	Per cent infected.	School.	Number examined.	Per cent infected.
Amaria ...	35	29	Madrasa Amaria ...	58	33
Bathurst Street ...	50	40	„ Armia ...	68	35
Buxton ...	98	55	„ Sulaimania	40	40
Bethel ...	97	55	Government Model ...	71	46
Cathedral ...	56	55	St. Anthony ...	141	35
Christ Church ...	53	43	St. Edwards ...	179	28
Cline Town ...	90	60	St. John's ...	69	56
Congo Town ...	39	56	Samaria ...	45	55
C. M. S. School ³ ...	26	*	Trinity ...	80	55
Ebenezer ...	52	71	Tabernacle ...	16	25

*No young children were examined in this school.

It will be seen that considerable differences exist in the proportions of children infected in the different schools. It might at first be thought that these figures could be used to indicate the malaria intensity of the district from which each school derives its pupils; this is not necessarily so as due allowance must be made for the fact that in some of the schools the children examined were very young and therefore at the most susceptible age; moreover all the schools were not examined at the same season of the year, some being inspected at the time of the highest malaria incidence, others at the time when malaria was at its lowest.

THE INSECT VECTOR OF MALARIA IN FREETOWN.

In another paper, shortly to be published, we enumerate the various species of house haunting anophelines encountered during a detailed survey of a portion of Freetown. The results obtained from this survey enable us to state that the only anopheline likely to be of practical importance in the transmission of malaria in Freetown is *A. costalis* (*A. gambiæ*.) and perhaps, though to a much less extent, *A. funestus*. We have succeeded in experimentally infecting both of these anophelines with *P. falciparum*, but, have failed to infect either species with *P. malariae*.

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E—ANTE-NATAL CLINIC—CAMPBELL STREET CENTRE.

A weekly Clinic was held at 99, Campbell Street throughout the year and was attended by patients from the Central and West Wards of the City. The patients are examined, watched, and given treatment at this Clinic and when necessary sent on to the Connaught Hospital for admission.

There were 442 individuals registered during the year and of this number 361 were pregnant.

The following table shows the attendances at the Clinic month by month:—

Ante-Natal Clinic—Table of Attendances, January—December, 1931.

Date.			New Cases.	Repeated Visits.	Total.
January	...	...	47	179	226
February	...	...	43	168	211
March	...	...	36	231	267
April	...	...	22	149	171
May	...	...	29	156	185
June	...	...	40	221	261
July	...	...	27	141	168
August	...	...	38	190	228
September	..	...	42	229	271
October	...	...	39	220	259
November	...	...	47	242	289
December	...	...	32	261	293
			442	2,387	2,829

The first column gives the number of new cases attending, and the second column the number of repeated visits, the last column being the monthly total of consultations.

Of the 361 pregnant women, 227 were multigravidae and 134 primiparae.

So far as cases can be traced we find that 106 delivered in hospital and 100 at home. As 251 women gave birth in the Maternity Ward of the Connaught Hospital it will be seen that approximately 40 per cent., had previously attended the Ante-natal clinic.

F—NOTES ON A MEDICAL SURVEY OF THE SIERRA LEONE
DEVELOPMENT COMPANY'S CAMPS AT SAHRMARANK
AND PEPEL, SIERRA LEONE.

BY

R. M. GORDON AND T. H. DAVEY

FROM

THE SIR A. L. JONES RESEARCH LABORATORY, FREETOWN.

INTRODUCTION.

A full report of this survey, including recommendations for the improvement of the conditions then existing, has already been submitted to the Medical Department, and in the notes which follow we only include such extracts as would appear to be of more than local interest.

The Sahrmarank camp is situated on the Port Loko Creek about three miles south-west of Port Loko which is the nearest town. The only villages adjacent to the camp are Roberi, which lies one third of the mile east, and Tongbai about a mile to the north-west. The camp is ninety feet above sea level, on a plateau which affords ample space for both the European and native lines, the latter lying 300 yards west of the nearest European house.

Pepel is a small Island about two miles square in the Port Loko Creek, separated from the mainland on its Northern aspect by a narrow creek. The village of Pepel is the only one of any considerable size but there are in addition a number of small villages scattered about the Island. A large part of the coast line consists of mangrove swamps which at many points penetrate deeply into the interior of the Island. Some of these swamps such as that east of the European lines and the marsh near Rosengbe are definitely tidal, others although not tidal are very saline. Towards the south side of the Island is a plateau about forty feet high on which are placed the European and native camps, the former being at a slightly higher elevation than the latter and lying some 300 yards north-east of it.

The actual mining operations will be carried out at Marampa, thirty miles north of Sahrmarank, from which point the railway will connect with the export depôt on Pepel, crossing the Port Loko Creek at Sahrmarank. The opening up of these labour camps at a season when food was scarce had resulted in an influx of natives from all parts of the Colony and Protectorate, and it was thought that this might result in the introduction or increase of certain diseases, which previous experience had shown not to be common in the district. Our work was therefore concerned with the examination of the native labourers in the camps for the presence of certain transmissible diseases and a search for their insect or snail vectors. As the Company's Medical Officer had already carried out a general medical examination of the recruits we were only concerned with those diseases which necessitated special laboratory examination, such as trypanosomiasis, schistosomiasis, filariasis, dysentery, and malaria. It is obvious that the medical inspection of natives specially recruited for heavy manual labour did not provide reliable information regarding the occurrence of these diseases in the native communities from which the recruits were obtained; on the other hand it afforded an opportunity of examining a large number of natives (over 1,400) under disciplinary conditions, where gland punctures, etc., could be carried out. The search for intermediate hosts has provided information regarding the potential vectors of disease in a part of the Colony which is likely in the future to become more thickly populated. Our survey was carried out during the months of March and April, 1931, and in addition Pepel was revisited for a single day in August of the same year.

Examination of Native Labourers at Sahrmarank and Pepel for potential carriers of Tropical Disease—As the labourers from all parts of the Colony and Protectorate were about evenly distributed in the two camps regardless of their place of origin, it is possible to consider together the results of the medical inspections in the two localities. At the time of our visit some 1,700 men were employed and of these 1,405 were examined for the conditions referred to.

Trypanosomiasis.—Special attention was paid to this disease on account of the prevalence of tsetse in the vicinity of the two camps, and the number of suitable breeding places still in existence. The surprisingly large total of 238 (17 per cent) of the men examined showed marked enlargement of the glands in the posterior cervical triangles. We performed gland puncture on 168 of these cases but the subsequent examination did not reveal trypanosomes in any instance. In neither camp were any cases seen clinically suggestive of trypanosomiasis, and we can offer no explanation of this high proportion of cervical adenitis, although the prevalence of scabies may have accounted for a few of the cases. Similar results have previously been noted in Sierra Leone by other observers, for example, Blacklock (1930) quotes a high proportion in the Protectorate, though not so high as that observed in our series.

Schistosomiasis.—It was impossible to examine the urines of all the labourers inspected but each man was asked if he passed blood in his urine and informed that if he did we possessed an efficient cure for it. Six of the men thus questioned stated that they were suffering from this condition. Specimens of urine from all six were examined and in two cases live *S. haematobium* ova were found; neither of these cases came from the Port Loko district, one being a native of Batkanu and the other of Panguma. On questioning the inhabitants in the neighbouring villages, although they recognised the disease, they stated that it was uncommon and that they knew of no cases in the district. We examined specimens of faeces from eight of fourteen natives who stated that they were passing blood *per rectum* but found no case of *S. mansoni* infection.

Filariosis.—Unfortunately, owing to the short time at our disposal, it was not possible to examine the day and night bloods of the native labourers for microfilaria. We therefore confined our attention to searching for *O. volvulus* infections by taking "skin snips" from such individuals as exhibited subcutaneous nodules. In twenty-nine (2 per cent.) such nodules were present and skin snips made from twenty-six of these revealed *O. volvulus* larvae in nineteen. Nine of these *O. volvulus* cases appeared to have acquired their infection in the neighbourhood, seven to have acquired it in Batkanu, one in Kabala, one in Songo, while the origin of the remaining case was doubtful.

Dysentery.—It was extremely difficult to estimate the incidence of this disease as we had to rely on histories given at our medical parades. When an individual stated that he was, or had been, suffering from dysentery, a request for a specimen of his stool frequently resulted in his disappearance. Of the 1,400 thus questioned, fourteen (1 per cent) gave a history of the condition. Specimens from eight of these were examined: two were negative; four contained blood and pus, and were of the bacillary dysentery type; two contained *E. histolytica*. Although dysentery thus appears to be rare at the Sahrmarank and Pepel camps, several cases were reported prior to our arrival. At a sick parade held at Bunsar, near another of the Company's camps, two cases of active amoebic dysentery were seen amongst the forty villagers who reported sick. At another small camp near Pepel several cases of dysentery occurred, the one case examined by us being probably bacillary.

Malaria.—No examination of the European or native populations was carried out. The former were taking quinine, and we had no reason to think that examination of the latter would yield results differing from those obtained in the rest of the Colony and Protectorate, where apparently every native is infected at one time or another.

Other diseases encountered.—In addition to the diseases above mentioned, a record was kept of certain other conditions which occurred amongst the 1,405 natives who were medically examined. Scabies was extremely prevalent, no less than 314 cases (22 per cent.) being recorded. As some of the men were only stripped as far as the waist it is certain that an even higher proportion were infected. The glandular enlargement sometimes associated with this condition probably accounted for a few of the cases of cervical adenitis already commented upon. A number of cases were seen of avitaminosis of the "A and B" type, first described in Sierra Leone by Wright (1930). The general improvement in the health and physique of the natives joining the Company's staff was very noticeable and was largely to be attributed to the excellent system of payment whereby each man, from the time he joined, daily drew an ample ration of rice as part payment of his wages. Undoubtedly, many of the labourers were half starved at the time that they were recruited and, not having money with which to buy food, their condition would certainly have deteriorated still further but for this provision. The few cases of avitaminosis which we saw, all gave a history of previous low diet or even starvation consequent on unemployment; at the time of our inspection all these cases were showing signs of improvement. Goitre was uncommon only seven cases being noted; it seemed to be equally uncommon amongst the indigenous inhabitants.

It will be seen from the above notes that little evidence of tropical disease was observed amongst the 1,400 natives examined, but as previously stated these results cannot be accepted as representative of a native community.

Search for the Insect and Snail Vectors of Disease at Sahrmarank and Pepel, together with observations on the results of their dissection.—The two camps presented rather different problems regarding the presence of, and the infection rate amongst, the different insect hosts, so that it is necessary to consider separately the results obtained in each camp.

(i) SAHRMARANK.

A single day was spent examining this camp in November, 1930 when it was found that tsetse flies (*Glossina palpalis*) were numerous throughout the camp area and that anophelines (*A. costalis* and *A. funestus*) occurred in the European compounds. At this time the only accommodation available for the Company's staff consisted of tents and shimbeks, and only a small clearing of bush had been completed. At the time of our visit in March, 1931 however, more permanent buildings had been erected and a very considerable clearing of the dense bush, measuring three quarters of a mile square, had been accomplished.

Trypanosomiasis.—The number of flies captured in the uncleared area was 140, and in the cleared area twenty-two. This total of 162 tsetse all proved to be *G. palpalis*. 118 were dissected and fourteen (12 per cent.) were found to be infected. The results are classified below.

TABLE I.

Showing the anatomical sites of infection in fourteen *G. palpalis* found to be infected with trypanosomes at Sahrmarank.

No.	Salivary glands.	Labrum.	Hypopharynx.	Gut.
1	0	0	0	+
2	0	0	0	+
3	0	0	0	+
4	0	0	0	+
5	0	0	0	+
6	0	0	0	+
7	0	0	0	+
8	0	+	+	+
9	0	+	+	+
10	0	+	+	+
11	0	+	+	0
12	0	+	+	0
13	0	+	+	0
14	0	+	+	0

It can be seen from Table I that no instance of salivary gland infection was noted, but the number of flies dissected is too small to allow of any conclusion being drawn regarding the absence of human trypanosomiasis. An analysis of the sites of infection shows that four of the infections were definitely of the *T. vivax* type, and three of the *T. congolense* type. The examination of stained films from the gut contents of the remaining seven positive flies revealed, in addition to the *T. congolense* type, a trypanosome of an unfamiliar species.

Animal life is fairly abundant around Sahrmarank. Crocodiles, which in Uganda are the vertebrate hosts of *T. grayi*, are common in the Port Loko Creek but we did not get an opportunity of examining their blood. The only deer which we examined, a duiker, showed in its blood a large trypanosome of the *T. theileri* type.

In view of the numerous breeding places offered by the oil-palm (*Elaeis guineensis*), and by felled trees in the neighbourhood, we did not think it necessary to search for additional breeding sites.

Schistosomiasis.—An extensive search was carried out both in the camp area and in neighbouring villages for *Physopsis globosa* and *Planorbis choanomphalus*. The former was demonstrated by Blacklock (1923) to be the intermediate host of *S. haematobium* in Sierra Leone, and the latter has been shown by Maass and Vogel (1930) to be the vector of *S. mansoni* in French Guinea not far from the Sierra Leone border. Although we offered as much as two shillings for a single specimen of either snail, none of the very numerous collections brought to us in addition to those collected by ourselves contained the right species. During the medical inspections, specimens of *P. globosa* were shown and it was noticed that, whereas the local inhabitants seldom recognised them, natives from the northern districts, such as the Konnos and the Korankos were in the majority of instances familiar with them. It is possible that, though absent in the dry season, the snail may appear during the rains, as we have observed in parts of Konno.

Filariasis.—We have shown that nine of the nineteen natives found infected with *O. volvulus* had acquired their infection locally, but although the vector, *Simulium damnosum*, is well known in the district in the wet season, at the time of our visit in the dry season no specimens could be obtained. Chrysops, the vector of *Loa loa* was not observed, but we understand that it has been noted in the camp subsequent to our departure. *Gulicoides austeni*, the vector of *A. perstans*, was not recorded. *Anopheles costalis*, a vector of *W. bancrofti*, was very common and its high incidence will be discussed under malaria. Two hundred and fifty mosquitoes of this species were dissected, and forty-two (17 per cent.) were found infected with filariae.

Malaria. (a) *Occurrence of Adults in the Houses*.—A single examination in the native camp was made of sixty-eight houses (consisting of seventy rooms) of which ten contained a total of thirteen anophelines (*A. costalis*). Six of these ten rooms were re-examined, a single *A. costalis* being captured on this occasion. In the European camp the native servants quarters were in close proximity to their masters' houses so that no discrimination need be made between anophelines caught in the boys quarters and in the corresponding European houses. Thirteen compounds consisting of thirty-four rooms were examined. As a result of a single search, we caught ninety-seven anophelines (ninety-six

A. costalis and one *A. funestus*). This gives a ratio of 2.9 anophelines per room, as compared with a similar ratio of 0.17 per room for the native lines. Thus, judged from these small figures anophelines were seventeen times as numerous in the European lines as in the native. We re-examined the European compounds on numerous occasions and found that the high anopheline rate was maintained, a further total of 241 *A. costalis* being collected. The potential danger of this anopheline density was found to be actual when these mosquitoes were dissected.

(b) *Results of dissection of anophelines*.—We examined a total of 250 anophelines, consisting of 203 *A. costalis* and one *A. funestus* collected in the camp, and forty-six *A. costalis* from the neighbouring village of Roberi. This series of dissections showed three anophelines infected with oocysts in the stomach and thirty-five with sporozoites in the salivary glands, giving a total of thirty-eight (15.2 per cent.) infected with malaria. This high anopheline infection rate, occurring in a European camp shown to contain a very large number of *A. costalis*, caused us to undertake a thorough search for their breeding places in the area.

(c) *Anopheline Breeding Places*.—Previous to our visit, rain had not fallen for several months so that it was impossible for us to forecast what conditions would exist during the approaching wet season. It was however obvious that during the rains the numerous borrow-pits that existed all over the camp would become filled with water and from suitable anopheline breeding places. Some of these pits were below the level of the swamp and had already been proved to contain *A. costalis* larvae as well as culicine larvae (*Lutzia tigripes* var *fusca*).

A swamp exists near the Port Loko Creek and to the north-west of the camp in which anopheline larvae (species *A. costalis* and *A. obscurus*) were demonstrated. Its area was, however, comparatively small and it was situated roughly 500 yards from the European lines and still further from the native lines. The extensive bush clearing of the camp had included a portion of this swamp and in our opinion it was a minor source of the anopheline infestation of the camp.

The southern swamp lay behind the native and European lines and parallel to the Port Loko Creek. Anopheline larvae (species *A. costalis*, *A. obscurus* and *A. marshalli*) were found at various points opposite the native lines in the muddy and tortuous stream which traversed the length of the marsh. It would appear almost certain that most of the anophelines occurring in the native lines came from this source. With a breeding ground in such close proximity it is surprising that so few anophelines were found in the native houses. We failed to find anopheline larvae in the stream as it entered the closed end of this marsh opposite the European lines.

The remaining swamp to be considered was that which lay due east of the European lines and intervened between the camp and Roberi village. The area involved was extensive, but sharply limited on both sides by steep banks, and somewhat bottle shaped, the base being the entrance into the creek, and the shoulders i.e., that portion at which it began to contract, being a considerable distance above the camp. The broad portion was 650 yards long, and 130 yards wide opposite the European lines. At this point, it was spanned by a native bridge which connected the camp with Roberi village and the Port Loko road. The marsh was traversed by muddy streams, two of which united at a point about 30 yards above the bridge and some 50 yards from the camp side of the swamp. When we visited the camp in November, 1930, this swamp was uncleared and its extent was very much greater, but since then the entire swamp had been cleared including its exit into the creek, though this latter work had only recently been undertaken. This clearing had greatly reduced the size of the swamp but unfortunately, owing to force of circumstances, no attempt had been made at canalization. In consequence, the sluggish and tortuous streams traversing the marsh had formed numerous anopheline breeding places. As a rule, it is difficult to obtain larvae from such sources, their distribution in so large an expanse of water, even in areas known to be supplying large numbers of adults, rendering the task of finding them very troublesome. In this instance, however, we had little difficulty in finding larvae, so that their actual number must have been very great. In our opinion this swamp was the source of the large number of anophelines found in European camp. The following species were obtained and bred out; *A. costalis*, *A. funestus*, *A. marshalli* var *hargreavesi*, *A. rhodesiensis*, *A. squamosus*, *A. mauritanus* var *paludis*, and *A. mauritanus* var *ziemanni*.

In order to corroborate our contention that the main source of anophelines was from this marsh, we undertook an investigation of the village of Roberi, already referred to, lying about 700 yards from the European lines, and about 180 yards from the swamp. On two occasions we examined the village for anophelines in a systematic manner. We first searched the newly erected shimbeks nearest to the swamp and then proceeded up the hill examining each house in turn, until we reached the original village of Roberi on the top, which before the opening of the camp had only consisted of four mud houses. The result of this experiment showed clearly that it was in the newly erected shimbeks nearest to the swamp that the greatest concentration of anophelines occurred, and that their numbers steadily diminished as we proceeded away from the swamp and European lines. Thus, the

six houses nearest the swamp yielded forty-seven *A. costalis*—while seven houses examined in the village only contained a total of eleven *A. costalis*.—The dissection of forty-six of these mosquitoes showed a similar malaria and filaria rate to that obtained amongst mosquitoes collected in the European lines. This strongly suggested that the infected anophelines found in the European lines had obtained their infection in the village of Roberi.

(ii) PEPEL.

The native village of Pepel was originally situated in elose proximity to the European camp, but the Company recognising the serious risk of illness from this source, took steps to build a new native village some 400 yards north of the European houses. At the time that we earried out the survey, steady building had been going on at the new site and some of the inhabitants of the old village of Pepel had moved into their new quarters. When we again visited the island some three months later, the migration was eomplete and the old village had been pulled down.

Trypanosomiasis.—Tsetse were much more abundant on Pepel Island than at Sahrmarank but the very thorough and extensive clearing already effected had greatly reduced their numbers in the camp, as is shown by the following figures. We captured a total of 301 flies during our fortnight's stay all of which were *G. palpalis*. Of the 301 *G. palpalis*, 264 were captured in the uncleared area and thirty-seven in the cleared area, the "fly per boy per hour" figure for the uncleared area was 1.0, and for the cleared area round the camp 0.3. The latter figure was probably too high, as it was impossible to prevent some of the too enthusiastic members of the gang leaving the cleared area in order to effect captures.

One hundred and fifty tsetse were dissected of which five per eent. were found to be infected, as compared with twelve per cent. at Sahrmarank.

TABLE II.

Showing the anatomical sites of infeetion in eight *G. palpalis* found to be infected with trypanosomes at Pepel.

No.	Salivary glands.	Labrum.	Hypopharynx.	Gut.
1	0	0	0	+
2	0	0	0	+
3	0	0	0	+
4	0	0	0	+
5	0	0	0	+
6	0	+	+	+
7	0	+	+	0
8	0	+	+	0

It will be seen from Table II that the types of infection encountered at Pepel were similar to those found at Sahrmarank. The five gut infections shown included specimens of the unidentified trypanosome already noted. Tables I and II show that of the 268 flies dissected none were found infected in the salivary glands, but the number of flies examined was too small to exclude the existence of the human type of infection in the district. Thus, though human trypanosomiasis undoubtedly exists at Aberdeen near Freetown, among dissections quoted of approximately 2,000 fly (Gordon and Davey 1930) only a solitary gland infection was noted. Game is more abundant at Pepel than at Sahrmarank. We examined the bloods of four duiker and one harness antelope; in one duiker the presence of a large trypanosome of the *T. theileri* type was found. No attempt was made to search for tsetse pupae, but undoubtedly these must exist in large numbers under the young oil palms which are very plentiful on the uncleared portion of the island.

Schistosomiasis.—The few breeding places suitable for vector (*P. globosa*) that existed around the camp during the dry season, were examined with negative results. Sick parades held for the local inhabitants appeared to show that the disease was unknown on the island.

Filariasis.—At the time of our survey in the dry season mosquitoes were negligible in the houses. But during the rains a quite different state of affairs existed and will be more fully discussed later. Of the eighty-nine *A. costalis* dissected at the time of our visit in the rains fourteen (15.7 per cent.) were found infected with filariae, presumably *W. bancrofti*. The biting fly *Chrysops longicornis* occurs on the island, but only a few were captured; six were dissected with negative results. The usual West African vectors *C. silacea* and *C. dimidiata* were not observed. *Simulium damnosum* appeared to be unknown. Culicoides (species not yet identified) were sufficiently numerous in the European lines to constitute themselves a pest on several evenings.

Malaria.—The ruins of a large trading station are still to be seen on Pepel Island, but it appears unlikely that Europeans have lived on the island since 1850. The Company's survey party who camped there during the rains of 1930 reported the presence of large numbers of mosquitoes, but since the erection of the present camp in the dry season of the same year there appeared to be general agreement on the part of the residents that mosquitoes were very uncommon. The greater portion of our time at Pepel was devoted to inquiring into the numbers of mosquitoes occurring in the houses, the existing breeding places, and the most likely sites for their occurrence in the rains.

We personally examined 100 houses in the native lines with great care and only caught a single *A. costalis*, while our examination of the entire European lines including the house-boy's quarters did not reveal a single mosquito. Likewise, the offices at the wharf, which at night are inhabited by watchmen, contained no anophelines and only a few culicines. This failure to find anophelines induced us to extend our observations to include ten suitable houses in the old native village of Pepel, and the only houses, six in number, so far inhabited in the new village; these yielded a total of three culicines and no anophelines.

This absence of anophelines even at the height of the dry season, is most unusual in Sierra Leone and was probably to be explained by the very limited amount of fresh water occurring in the vicinity of the camp at this time of year, for our systematic search failed to reveal a single stream or spring anywhere near the camp. The entire water supply for the local inhabitants and the newly arrived labourers and Europeans is derived from wells. Two of these are old native wells which supply the village of Pepel, while the Company's water supply is obtained from two other wells which have only recently been sunk. All four were examined and in addition we dredged the water in the two storage tanks which are fed from the European wells; no larvae were found in any of these supplies. Small collections of casual water were noticed around the native wells, the stand pipes in the native lines and the unlined gutters running from them, disused tipping trucks, and also in a large felled cotton tree; only the latter, however, was found to contain larvae, *Aedes (stegomyia) fasciata*, and *Culex (culicomyia) nebulosa*.

Although mosquitoes were so conspicuously absent from the European and African houses, one became aware of their presence immediately on entering any of the swamps which existed around the periphery of the island. We captured a large number of these mosquitoes, many of them while biting, and in every instance found them to be culicines and of the same species as those captured in the houses in the camp and village. It was clear that in whatever place these culicines were breeding it was possible that anophelines might also be found. A preliminary search of such open water as existed in the marshes* around the camp failed to reveal any obvious breeding place for these mosquitoes, and it was not until we examined the crab holes on the immediate outskirts of the swamps that larvae were found. Although individual crab holes seldom contained great numbers of larvae, yet these crab holes were so numerous and so widely distributed that they represented an enormous breeding ground which in some instances approached close to the native and European lines. These crab holes always had the same construction, consisting of a tortuous tunnel connecting the mouth of the burrow with a cavity containing several inches of water. The latter, in which the larvae were found, usually lay at a depth of three to four feet from the surface of the ground though occasionally larvae occurred at greater or less depths. It was noted that only the crab holes towards the periphery of the swamp contained larvae. Digging out even a single crab hole was a troublesome task and often required five or six hours work, the difficulty being augmented by the necessity of sinking a countershaft to avoid blocking the burrow with earth. The following mosquitoes were obtained from the crab holes thus examined: *Aedes (aeditomorphus) nigricephalus*, *Aedes (A) irritans*, *Aedes (A) sp. probably tarsalis*, *Culex rima*, *Culex philipi*, *Culex sp.? perfidiosus* or *decens var invidiosus*, *Uranotaenia annulata*. It will be seen from this list that no anophelines were found in the crab holes examined, but various writers from other parts of West Africa have recorded their occurrence in crab holes containing waters of various degrees of salinity. In the absence of other and more usual anopheline breeding places we decided to investigate the distribution of these crab holes and to estimate the salinity of the water contained in them. In Table III, we give the saline content of the water obtained from a number of such burrows in which larvae were, and were not, found.

*We use the terms "swamp" and "marsh", but at the time of our visit, these areas were dried up, although probing the surface nearly always revealed water, in some instances at a depth of only a few inches.

TABLE III.

Showing the saline content of specimens of water collected from crab holes in the marshes at Pepel.

Situation.	Presence of larvae.	Chlorine content expressed as percentage sodium chloride solution.
Marsh east of European lines ...	0	3.4
" " " " " ...	0	3.7
Margin of same marsh ...	+	1.9
Marsh north of the native lines	0	2.9
" " " " " ...	0	1.9
Marsh north of new village ...	0	2.8
" " " " " ...	+	1.3

It will be seen from Table III that larvae were not obtained from crab holes the water of which contained more than 1.9 per cent. of Sodium Chloride (sea water contains approximately 3 per cent. Sodium Chloride). Although we failed to find anophelines in the crab holes examined this was probably not due to their saline content, for records from other West Coast Colonies (Evans 1927) prove that *A. costalis* can breed both in crab holes and in waters of higher salinity than those in which we found larvæ breeding at Pepel. This question of salinity appeared to us to be of some importance, for although we could find no open pools in the marshes close to the camps, yet water was very near to the surface as shallow excavations not more than two feet deep invariably revealed it. Several pits of this nature had already been made and contained water so saline that anophelines larvæ placed in it died with a few hours. We thought it probable that during the wet season, the constantly increasing dilution by rain of the salt water in the marsh would eventually render these areas capable of maintaining an anopheline population. This idea was supported by the fact that larvæ-containing crab holes on the edge of the swamp held water of a much lower salinity than those in the centre.

In order to ascertain to what extent adult anophelines were to be found in the houses during the rains and if found whether our conjectures as to the formation of breeding places were correct, we revisited the camp for one day at the height of the rains in August, 1931. This visit confirmed our fears regarding the establishment of anopheline breeding places, and revealed a totally different state of affairs with respect to the number of anophelines occurring in the houses. Anopheline larvæ were found breeding in numbers in the marsh north of the native camp, and were also numerous in the many borrow pits which had resulted from the constructional operations; samples of these larvæ were bred out and all found to be *A. costalis*. Adult anophelines of the same species abounded in the houses in both the European and native camps, as many as eighty-seven being captured in half-an-hour's search of two European compounds. The risk of acquiring malaria in this camp in even a short sojourn must have been very great for the malaria infection rate amongst these anophelines was found to be 13.5 per cent., a figure founded on the dissection of ninety *A. costalis* captured in the sleeping rooms.

We have just referred to the fact that in the dry season pits dug in the marsh besides the native lines contained water so saline that anopheline larvae failed to survive in it. At this time we had also examined water at another point in the marsh and found its saline content to be 2.9 per cent. and that no larvae were present. On the occasion of our visit in the wet season the heavy rains had reduced the saline content in this marsh to 0.18 per cent. and anopheline larvae were now living there freely.

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G—REPORT OF THE CHIEF REGISTRAR OF BIRTHS AND DEATHS.

1. *Staff*.—Chief registrar, the Assistant Director of Health Service.
Deputy Chief Registrar, the Medical Officer of Health.

Freetown—Registrars	...	...	...	...	1
Freetown—Deputy Registrars	...	...	...	...	2
Colony (other than Freetown)—Registrars	...	...	...	...	15
Colony (other than Freetown)—Deputy Registrar	...	...	...	...	1
Protectorate—Registrars	...	...	...	...	10
Protectorate—Deputy Registrars	...	...	...	...	22
					—
					51
					—

2. *Population*.—The Returns of census taken during the year under review show the following figures:—

3. *Legislation*.—The following Ordinances affecting the Registration of Births and Deaths were passed:—

	Males.	Females.	Total
Freetown	30,012	25,347	55,359
Colony (other than Freetown)	22,541	18,522	41,063
Protectorate	796,391	875,666	1,672,057

- “ The Births and Deaths Registration (Amendment) Ordinance, 1931.”
“ The Aku Mohammedan Burial Board Ordinance, 1931.”

The former applies registration to chiefdoms in the Protectorate whereas formerly it was applied only to Health Districts, which in many cases were very small parts of a chiefdom.

It further defines four system of registration:—

- (1) Compulsory Registration within the Colony.
- (2) Compulsory Registration of non-natives in the Protectorate.
- (3) Compulsory Registration of natives in chiefdom (as defined above).
- (4) Optional Registration of natives not born or dying in a Registration District.

The Aku Mohammedan Burial Board Ordinance vests the Aku Mohammedan Cemetery in Freetown in a Burial Board, and provides for the more efficient registration of all burials performed there by means of burial permits

Freetown.—The number of births registered in Freetown was—males, 629 and females 634, giving a total of 1,263 (Tables A. and B.) while the total number of deaths in Freetown (Table F.) was 1,380; 772 being males and 608 females. Showing an increase of deaths over births of 117. This may be accounted for—at least in part—by the difficulty still found in securing the registration of all births among aborigines from the Protectorate.

The birth-rate (Table G.) for Freetown was 22.73 per 1,000 as compared with 22.04 per 1,000 in 1930. Although every effort has been made to secure the registration of all births these figures cannot be considered more than approximately accurate.

The death-rate (Table H.) shows a decrease of from 27.16 per 1,000 in 1930 to 24.84 in 1931. As no burials can take place without a certificate from the Registrar these figures may be accepted.

Still-births registered numbered 52 (Table C.). This figure cannot however be considered accurate for the reason given in the 1930 report, viz., the reluctance of African women disclose that they have not carried to full term.

Infantile mortality shows an appreciable decrease, the figures for 1930 and 1931 being 336·64 and 288·99 respectively (Table D.).

Principal causes of death (Table J.). Only 23·3 per cent. of the total deaths were certified by Medical Practitioners. This table therefore cannot be considered to be correct, but is a fair guide to the principal causes of death.

Colony (other than Freetown).—The number of births registered was 838, an increase of forty-eight. Of this number, 433 were males and 405 females (Tables A. and B.) deaths registered numbered 925 as opposed to 839, an increase of eighty-six. These figures however cannot be considered other than approximate. In the case of births, there is less supervision over natives from the Protectorate than is exercised in Freetown and probably a greater proportion are left unregistered. Unfortunately, all the Colony cemeteries are not yet controlled, and it is possible that a number of deaths have not been registered. Legislation on this matter is being considered. As the figures stand deaths exceed births by eighty-nine. In both cases there is an increase over the figures for 1930.

Birth-rate.—(Table G.) compared with 1930, the birth-rate shows an increase of 2·9 the figures being 17·5 per 1,000 in 1930 and 20·4 per 1,000 in 1931. The figure for 1931 is ·36 per 1,000 above the average for five years.

Death-rate.—(Table H.) the rate of 22·52 per 1,000 for 1931 exceeds the figures of 18·64 per 1,000 for 1930 by 3·88, but exceeds the average for five years by only 1·33 per 1,000.

The Infantile Mortality Rate.—(Table D.) shows a decrease, the figures for 1930 and 1931 being 249·36 and 227·92, the decrease being 21·44.

Still-births are registered only in special districts—apart from Freetown—and apply to Colony and Protectorate. The remarkably low figures is consequent upon the fact that native women are intensely unwilling to record such a thing.

PROTECTORATE.

It must again be emphasized that the figures apply only to comparatively small and isolated districts, and therefore are useless for the purpose of statistics. In the twenty-two districts, the following registrations were made:—

Births—Five hundred and fifty-seven compared with fifty-five in 1930. A large increase owing to a change in some registrars and the fact that a number of births of over three months up to and over one year have been registered.

Deaths.—The number of deaths registered also shows a large increase, due almost entirely to the appointment of new deputy registrars and the watchful eye of the Protectorate Medical Officers who act as Registrars for their districts.

It will be some years before the registration of births and deaths can be applied to the whole Protectorate, but as time goes on the figures will show a gradual approximation to the accurate.

Table “ K ” showing the number of births, deaths, etc., registered in each registration district in the Protectorate, and also the activities of District Registrars, is attached.

J. A. A. DUNCAN,
Chief Registrar.

A.
Number of Births registered 1927—1931.

District.	1927.	1928.	1929.	1930.	1931.
Freetown	1,010	1,036	1,093	1,102	1,263
Colony	927	950	929	790	838
Protectorate ..	67	83	117	55	+ 557
Total ...	2,004	2,069	2,139	1,947	2,658

+ Increase in 1931 due to :—
(a) Registration of births of 3 months up to and over 1 year.
(b) Change in Registrars.

B.

Total Births Registered in 1931.

District.			Male.	Female.	Total.
Freetown	...	...	629	634	1,263
Colony	...	...	433	405	838
Protectorate	...	...	276	281	557
Total			1,338	1,320	2,658

C.

Still-births Registered in 1931.

District.			Male.	Female.	Total.
Freetown	...	...	31	21	52
Special Districts	..		3	3	6

D.

Infantile Mortality for 1931.

Freetown	...	...	...	...	288·99
Colony	...	...	...	...	227·92

E.

Number of Deaths Registered 1927—1931.

District.		1927.	1928.	1929.	1930.	1931.
Freetown	...	1,290	1,389	1,450	1,358	1,380
Colony	...	865	1,040	1,007	839	925
Protectorate	...	69	42	98	17	452
Total		2,224	2,471	2,555	2,214	2,757

+ Increase in 1931 due to change in Registrars

F.

Total Deaths Registered in 1931.

District.		ADULTS.		CHILDREN.		Total.
		Males.	Females.	Males.	Females.	
Freetown	...	432	318	340	290	1,380
Colony	...	323	227	201	174	925
Protectorate	...	121	152	98	81	452
Total		876	697	639	545	2,757

G.

Birth-rate per 1,000 from 1927--1931.

District.		1927.	1928.	1929.	1930.	1932.
Freetown	...	20.5	20.72	21.86	22.04	22.73
Colony	...	20.6	21.1	20.6	17.5	20.40

II.

Death-rate per 1,000 from 1927--1931.

District.		1927	1928.	1929.	1930.	1931.
Freetown	...	25.8	27.78	29.	27.16	24.84
Colony	...	19.22	23.11	22.37	18.64	22.52

I.

Death Certification—Freetown and Kissy, 1931.

European Hospital.	Connaught Hospital.	Princess Christian Mission Hospital.	Kissy Institutions.	Private Practitioners.	Ships in Harbour.
3	169	31	45	91	—

J

Principal Causes of Death at all ages in Freetown in 1931.

Malaria	...	...	243	Cerebral Haemorrhage	...	12
Bronchitis	...	...	210	Asthenia	...	10
Pneumonia	...	...	141	Pleurisy	...	10
Senility	...	..	98	Cough	...	9
Cardiac Failure	...	...	82	Tetanus Neonatorum	..	6
Debility	...	...	74	Peritonitis	...	6
Premature Birth	...	...	66	Paralysis	..	5
Infantile Convulsions	...	...	53	Congenital Debility	...	5
Enteritis	...	...	42	Inanition	...	5
Strangulated Hernia	...	...	31	Atelectasis	...	5
Septicæmia	...	...	28	Stricture (unqualified)	...	5
Heart Disease	...	...	26	Asphyxia	...	5
Tuberculosis, all forms	...	...	26	General Anasarca	...	5
Diarrhœa	...	...	24	Apoplexy	...	4
Rheumatism	...	...	24	Blackwater Fever	...	1
Abdominal Disease	...	...	24	Hemiglegia	...	3
Nephritis	...	...	24			
Tetanus	...	...	24			

NUMBER OF BIRTHS AND DEATHS RECORDED AT ALL DISTRICTS IN THE PROTECTORATE.

	BIRTHS.			DEATHS.			DEATHS UNDER TWELVE MONTHS.			STILL-BIRTHS.		
	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.
Pujehun	—	3	3	9	4	13	—	—	—	—	—	—
Sulima	2	3	5	5	—	5	—	—	—	—	—	—
Sumbuya	1	1	2	1	1	2	—	—	—	—	—	—
Shebar	5	4	9	1	2	3	—	—	—	—	—	—
Moyamba	6	9	15	—	—	—	—	—	—	—	—	—
Sembehun	1	—	1	—	—	—	—	—	—	—	—	—
Baiya	3	5	8	2	2	4	—	1	1	—	—	—
Mabang	5	6	11	14	8	22	4	3	7	—	—	—
Mano (N'jala)	—	—	—	—	1	1	—	—	—	—	—	—
Bo	19	7	17	4	—	4	—	—	—	—	—	—
Kenema	13	6	19	4	3	7	1	1	2	—	—	—
Panguma	5	8	13	6	2	8	—	—	—	—	—	—
Daru	9	7	16	8	10	18	2	—	2	—	—	—
Pendembu	76	96	172	70	90	160	16	18	34	—	—	—
Kailahun	73	63	136	53	70	123	5	3	8	—	—	—
Kabala	1	—	1	10	3	13	1	—	1	—	—	—
Makene	14	9	23	1	1	2	—	—	—	—	—	—
Port Loko	19	24	43	15	18	33	8	1	9	—	—	—
Batkanu	16	12	28	8	5	13	—	1	1	—	—	—
Kambia	14	15	29	8	13	21	1	3	4	—	—	—
Kaiyima	3	3	6	—	—	—	—	—	—	—	—	—
Total	276	281	557	219	233	452	38	31	69	—	—	—

H.—REPORT ON INVESTIGATIONS INTO THE PROBLEM OF OEDEMA

BY

W. A. BURNETT, B.Sc., M.B., CH.B., D.T.M. and H.

A pathological condition diagnosed as the Oedematous type of Beriberi has been present for many years in Sierra Leone, culminating at intervals in outbreaks of epidemic severity with a high rate of mortality. This report is a resume of some investigations made into the disease as it affected Freetown, with special reference to Wilberforce Barracks, Freetown Prison and Kissy Asylum, combined with an enquiry, working along biochemical lines, into the relationship of this disease with the nutritional aspects of rice. The report is subdivided to a number of headings, which are dealt with seriatim and finally summarized. A certain amount of statistical data is incorporated in the report, and, in addition, there is an addendum dealing with the conditions at the Wilberforce Barracks Compound.

The problem of Beriberi is one which has been noted in Freetown Prison for at least the last forty-eight years. At this institution it had been reported under several diagnoses, to wit; Oedema, Dropsy, Beriberi, Dysentery with Dropsy. Various spasmodic references have been put on record until recently when an investigation was made by Professor Blacklock (1) in 1922, and later in 1929, when Drs. Leitch and Watson (2) undertook an intensive and exhaustive survey of the condition at the Freetown Prison. The outcome of their work was that drastic alterations in management were suggested, together with the allowance of a diet very rich in vitamin B and of high calorie value, as much as thirty-five hundred calories being allowed to adult male prisoners on sedentary occupation. "There is no excuse for its existence, as it can be guarded against by easily arranged and inexpensive measures; given an adequate diet, all that remains is to see that the vitamin B content of the diet remains up to standard," quote the joint authors of "Beriberi in the Freetown Prison," yet despite the most strict adherence by the Superintendent of Prisons to this dietary advice, coupled with the daily inspection of the inmates' food rations by the prison doctor, the Medical Officer in charge of Freetown Prison continued to find this "Oedema" cropping up among the prisoners and culminating in a severe outbreak in 1931. A diet rich in yeast, cod liver oil, fresh vegetables and fruits, despite the reputedly high content of vitamin B had failed to prevent a serious recurrence of the condition. At that time large quantities of Marmite and Bemax were being given without the success one would have expected from these "vitamin" foods, if the condition had been one purely of avitaminosis. It was only after an alteration of the diet to consist of new rice, a step suggested by Mr. Biddle, the Superintendent of Prisons, from his lifelong experience of the condition, that a mass improvement set in and no new cases were reported. It seems a great pity that his valuable first-hand knowledge of this diseases does not appear to have been utilized to better advantage in some of the previous epidemics.

During the period from August 1931 to January 1932, there was a very considerable outbreak of the oedematous condition here involving Freetown Prison, Wilberforce Barracks and Kissy Asylum. A number of Freetown inhabitants, too, complained of the disease and were treated at the Connaught Hospital.

This was the position in November, 1931 when the Honourable Director of Medical and Sanitary Services (Dr. J. C. S. McDouall) requested me to study the problem with special reference to biochemical observations on the rice as both he and Mr. Biddle had been since 1929 dissatisfied with the diagnosis of Beriberi due to avitaminosis, and suspected a toxic poisoning following the ingestion of diseased rice, or a condition resembling the nature of the Epidemic Dropsy of India.

The Condition Clinically.

It is considered essential to outline the disease under review in terms of the clinical picture. The syndrome takes the form of a varying degree of non-albuminuric oedema, usually well defined in the limbs; of dyspnoea on the minimum exertion and of tachycardia with enlargement mainly of the right heart; of muscular weakness with deep muscular hyperaesthesia; of gastro-intestinal disturbances, generally constipation, sometimes followed, in the fatal cases, by diarrhoea and faecal blood, and of such nerve changes as are displayed by diminution of, or loss of tendon reflexes, localized and often transient anaesthesia and deep hyperaesthesia. Difficulty of vision is present at times. There may be, and generally is, a slight pyrexia, but the fever does not usually exceed a range of 99°F to 101.5°F.

Were the signs and symptoms to be summarized and depicted in a typical case, it would be observed that the patient complains of weakness and of being easily tired. He has breathlessness and palpitation on exertion, with a variable amount of praecordial pain. The epigastrium may be tender and show fullness and there may be associated a history of nausea and vomiting. There is generally considerable weakness of the calf muscles which are painful to deep pressure; the patient may be unable to raise the legs in bed and to perform the "squatting test," although this should not, I think, be considered a diagnostic test for Beriberi. Foot drop and wrist drop may occur, but were not seen in the cases under review. Often coupled with a previous history of generalized muscular rheumatic pains is one of chronic constipation. In many of the fatal cases this occurrence of intestinal stasis is followed by a sharp bout of diarrhoea with blood at the latter part of defaecation.

With this muscular weakness oedema makes its appearance and it usually starts in the feet extending rapidly to the legs and being well marked over the pretibial area. It may come on with remarkable suddenness, appearing in twelve to twenty-four hours, coupled with praecordial distress and cardiac enlargement to the right. The dropsy is symmetrical and feels more solid than that of nephritis. Generally, the swelling remains localized to the lower limbs, but, on occasion it may be found extending to the knees, thighs and scrotum, while it may also involve the abdominal wall and, rarely, the face. If the patient is recumbent the sacral area is affected in addition to the limbs. Oedema of the sternum has seldom been recorded and in the cases under observation it was seen only in three men.

In the early stages there occurs a partial anaesthesia to pain, (pinpricks), touch, kinaesthetic sensation and heat but not to intense cold over the oedematous zones. This superficial anaesthesia steadily becomes more pronounced as the dropsy persists until complete loss of cutaneous sensation is the result. On the other hand, when the swelling is successfully treated, the anaesthesia is rapidly abolished although recovery does not set in till about fourteen days after the oedema has disappeared.

The tendon reflexes are altered, diminished and often finally absent in the patella, tendo achilles and cremaster, but the reflexes of the biceps and triceps and of the forearm muscle tendons, together with jaw jerk are present and may be slightly exaggerated. About 15 per cent. of the cases showed no alteration of the tendon reflexes. The abdominal reflexes are not reliable as they cannot be elicited with any degree of accuracy even in the normal African subject. The reactions of the eye to light and on accommodation are normal and unaffected. A few patients complain of difficulty with the sight; objects become blurred and dim and light has a painful effect on the eyes. The intraorbital pressure is increased together with other allied signs of early glaucoma. The patient will often show a positive Romberg sign and generally he walks with an unsteady, high-stepping gait. There is no loss of the sphincter control either of the bladder or of the anus.

Even at rest the heart rate is considerably increased, tachycardia being most consistently present. The cardiac muscle is dilated in all directions, especially to the right, and there may be a soft systolic murmur with equal spacing of the heart sounds. Except in the final stages of pericarditis with effusion, there is no muffling of the cardiac sounds. In all cases complaints are made of palpitation and of praecordial distress with pain that does not radiate outwards and down towards the left arm. The onset of pericarditis with effusion is very rapid and very common. Many patients have a marked venous pulsation in the neck. The pulse rate is steadily increased from the normal to one hundred to one hundred and twenty per minute. Although constantly rapid, the pulse has good volume and tension and the rhythm is regular.

The blood examination does not reveal any obvious pathological change. There is a slight hydræmia associated with diminished red cell count (average 4,300,000 per cu. mm.) and with a lowering of the hæmoglobin content to 70 per cent. The colour index is generally found to be in the region of 0.81. Although the white cell count ranges from a value of 7,000 to 11,000 per cu. mm., the most marked change in this aspect of the blood is the decided shift to the left in the Arneth Index. Quite a considerable proportion of bilobed and trilobed polymorphonuclear leucocytes is to be seen.

Records of the blood pressure are found to vary in the people affected in accordance with the state of the bowel and of the heart. During the phase of sub-acute or chronic constipation, there is a definite elevation to 156–170 mm. Hg. systolic (90–106 mm. Hg. diastolic) but when recovery sets in or the intestinal stasis is relieved for a few days this blood pressure steadily falls by 20–30 mm. and is maintained at a lower level, 136–140 mm. systolic (70–84 mm. diastolic). Where the signs of pericarditis with effusion are present coupled with diarrhoea, the blood pressure is constantly low (100 mm. systolic 60 mm. diastolic); when these patients are recovering, which they do very slowly, the blood pressure is equally tardy in rising to the normal and in the cases under review, no one exceeded a final reading of 118 mm. systolic, 72 mm. diastolic.

The urine shows none of the ordinary abnormalities. It is free from sugar, diacetic acid, acetone bodies and albumin, but although just slightly diminished in amount it contains an excessive quantity of phosphates, which separate on cooling.

The results of the post-mortem examinations will be given in a separate record included in the section on laboratory observations.

WILBERFORCE BARRACKS.

The conditions at Wilberforce Barracks, where are stationed soldiers of the Royal West African Frontier Force, render the study of epidemic and general diseases much simpler than among the general African populace. The Commanding Officer, (Lieutenant-Colonel Greene) and his colleagues gave every possible assistance towards the work and they are to be complimented highly on the tact with which they dealt with their men and on their indirect persuasive powers among the "camp followers," with the net result that routine inspection, generally a difficult affair in the concern of the undisciplined, was facilitated and became a matter of pleasure. I have to put on record the valuable assistance rendered to the work by dresser Roberts, who was of a very material service in obtaining statistical data from the soldiers.

The Barracks.—The Barracks Compound, of which a plan is submitted, is situated on a hill sloping fairly gently downwards in all directions. The lines of huts are placed in parallel rows running north and south. The huts occupied by the soldiers are of mud construction, measuring over all 45 feet by 34 feet. They are separated from one another by a minimum clear space all round varying from 18 feet to 33 feet wide. On each long side is a verandah 6 feet wide. The huts are subdivided by mud walls 8 feet 6 inches high and 6 inches thick, into eight rooms each measuring 10 feet square. The walls do not extend to the roof, which, at the highest point, is 11 feet. A ceiling is formed by stretching over the top of the walls a horizontal layer of wide mesh wire netting. The floors, including the verandahs, are built up 3 feet 6 inches above the ground level. Each room has one window, capable of opening, and one door, but in some of the huts the partition wall has been cut to make an internal communication between adjacent rooms. During the day the rooms are cool, chiefly on account of the covering of thick thatch on the corrugated iron roof, which is carried well down over the verandah to provide shade and to reduce the ingress of reflected heat from the ground. All the rooms are more or less infested with bedbugs (*Cimex lectularius*, *Leptocimex boueti* and *Cimex rotundatus*) and the possibility of migration, not only from room to room, but from hut to hut, is far from remote.

Cooking.—Generally, the cooking is conducted in communal kitchens, which are huts with freely opened partition walls. Individual fires are employed and the cooking is conducted by the women, who use the kitchens as convenient places wherein to beat the rice by the native mortar and pestle method.

Latrines.—The latrines are well isolated and at least fifty yards from the huts of the Compound. Men and women use separate buildings, which are erected to accommodate the dry bucket system. The faecal matter is buried in a large pit, 200 yards from the nearest hut and to the prevailing leeward side of the Compound. These conveniences are kept clean and tidy and are inspected regularly by the Sanitary Inspector allocated to the Barracks.

Drainage.—Open surface gutters are in use for drainage with water channels running away from each hut. As the Compound is built on rock on an exposed sloping hill the drainage is ample, well designed and sufficient.

Water Supply.—The water supply is brought in by pipe line from the Hill Station supply and laid to convenient automatic stop cocks; no waste is permitted.

Rubbish Bins.—Small rubbish bins with steel lids are located near the water taps (about 20 feet from each one). These appear to be used with disciplinary care, as no evidence is visible of indiscriminate scattering of rubbish and there are sufficient bins to accommodate the refuse without piling it up around the receptacles. They are emptied daily and the rubbish is incinerated.

Wash Houses.—Wash houses are separated from the Compound on the eastern side of the hill.

On the whole the Compound is tidy, well kept and efficiently managed, as far as sanitation is concerned.

The Epidemic.

At the end of October, 1931, the disease was first brought to notice by a soldier complaining of swollen legs, constipation and breathlessness on exertion. His heart sounds were soft and muffled but there were no valvular murmurs. The urine displayed no abnormalities

(albumin, sugar, acetone bodies) but it contained an excessive amount of "earthy" phosphatic deposit. It was considered advisable to have the man admitted to and treated at the Connaught Hospital (Ward 2) where, however, he died two days after admission. He had been ill for seven days.

The necropsy revealed acute pericarditis with effusion (8 oz.), cardiac enlargement, pulmonary œdema, scanty volume of fluid in the peritoneum, hepatic œdema, enlarged gall bladder with normal bile and œdema of both legs extending only to the knees. The cause of death was diagnosed as Beriberi of the wet type and pericarditis with effusion.

Survey of Troops.—On account of the presence of Beriberi at Freetown Prison and of the information that the Troops were being issued with rice from the same contractor who supplied the Prison, it was deemed essential to take urgent measures to round up all affected soldiers. Consequently, a survey of the entire personnel at the Soldiers' Compound was undertaken to isolate similar patients and to anticipate early cases. To facilitate this work, I drew up a scheme of which the following is a resumé.

All the huts and rooms were numbered and a plan was made of the Compound, showing such details as position of huts, kitchens, latrines, drains, rubbish heaps and water supplies. Small metallic discs were figured with the hut and room numbers. They were issued to the responsible occupants of each room, with the instructions that on any complaint of sickness by any inmate, such patient should appear with the disc at the morning sick parade, so that any disease, whether of an infectious nature or otherwise, could, by comparison with the numbered plan at the Medical Officer's hut, be localized immediately and, if need be, suitable steps taken at once. The misuse of discs by persons is an offence punishable on the owner of the disc, and loss of disc is notifiable immediately. This scheme had the approval of the Commanding Officer, and it was of great service to the research.

A census of the soldiers' lines in the Compound was made to find:—

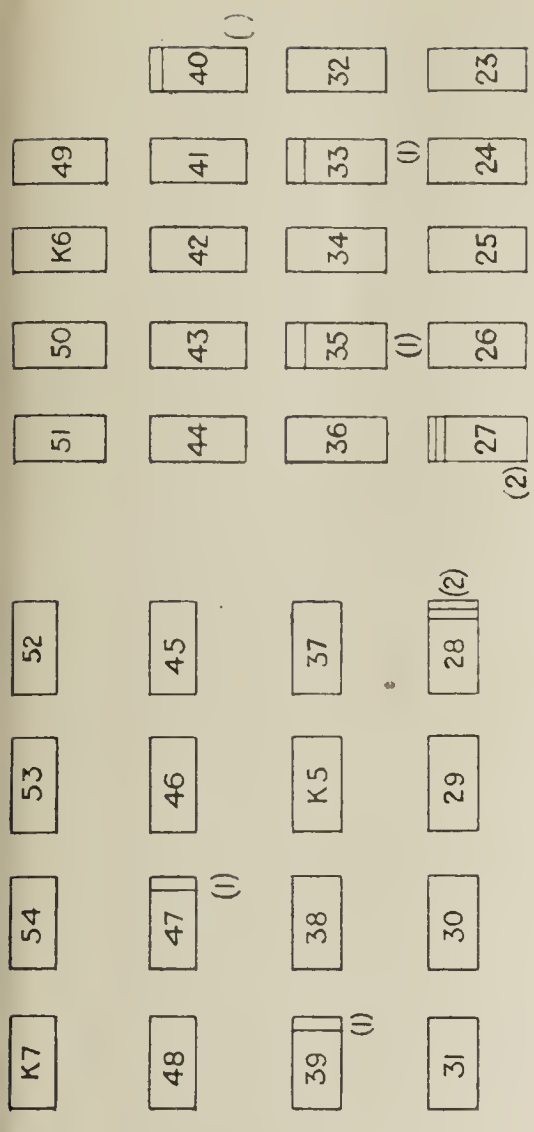
- (a) Number of persons in each room.
- (b) Distribution to adults, children and servants.
- (c) Distribution of rooms used as kitchens and as stores (occupied and unoccupied).
- (d) Number of beds per room.
- (e) Presence or absence of mosquito nets.
- (f) Presence of dogs, fowls, and pets (guinea pigs).

With very few exceptions, all complained of the presence of bedbugs.

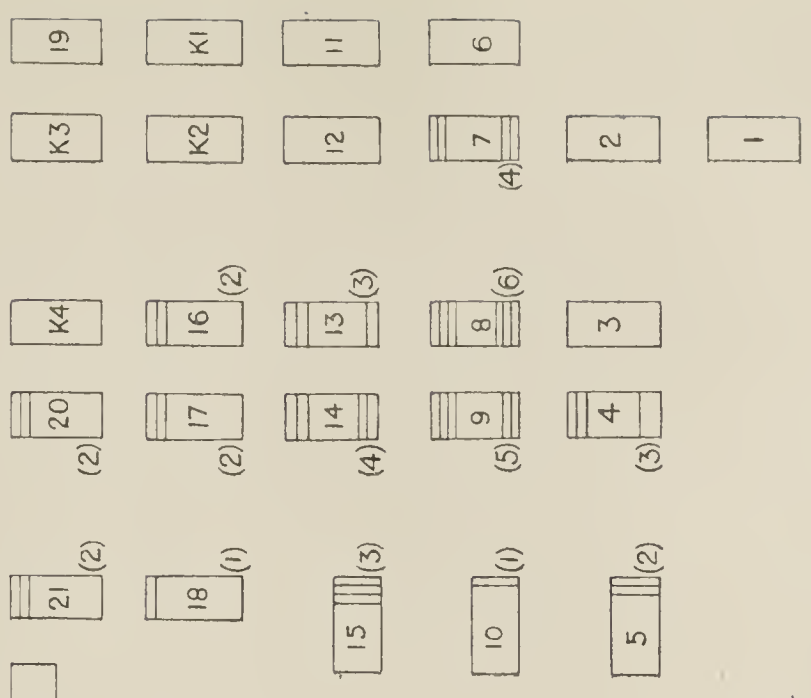
Appended are the results, of which an extract is submitted below:—

ADULT.		CHILDREN.		SERVANTS.	
Men.	Women.	Male.	Female.	Boys.	
226	185	31	49	63	Total 554
Huts.				Kitchen Huts.	
54.				7	Total 61
61×8—488 units					
Rooms occupied	...	...	304	} All expressed in units of one room that is eight units per hut,	
„ empty	...	...	41		
Stores occup ed	...	...	17		
„ unoccupied	...	...	34		
Kitchens	...	...	76		
Huts, derelict (2)	...	...	16		
				488	
Beds screened	...	...	197		
„ unscreened	...	...	211		
OEDEMA CASES.					
Men.	Women.	Children.		Servants.	
30	19	Male 1	Female 0	4	Total 54 (including one fatal)

From the data obtained in the survey of the Compound the cases of œdema are tabulated below in terms of hut, room, sex, presence of pets and screens.



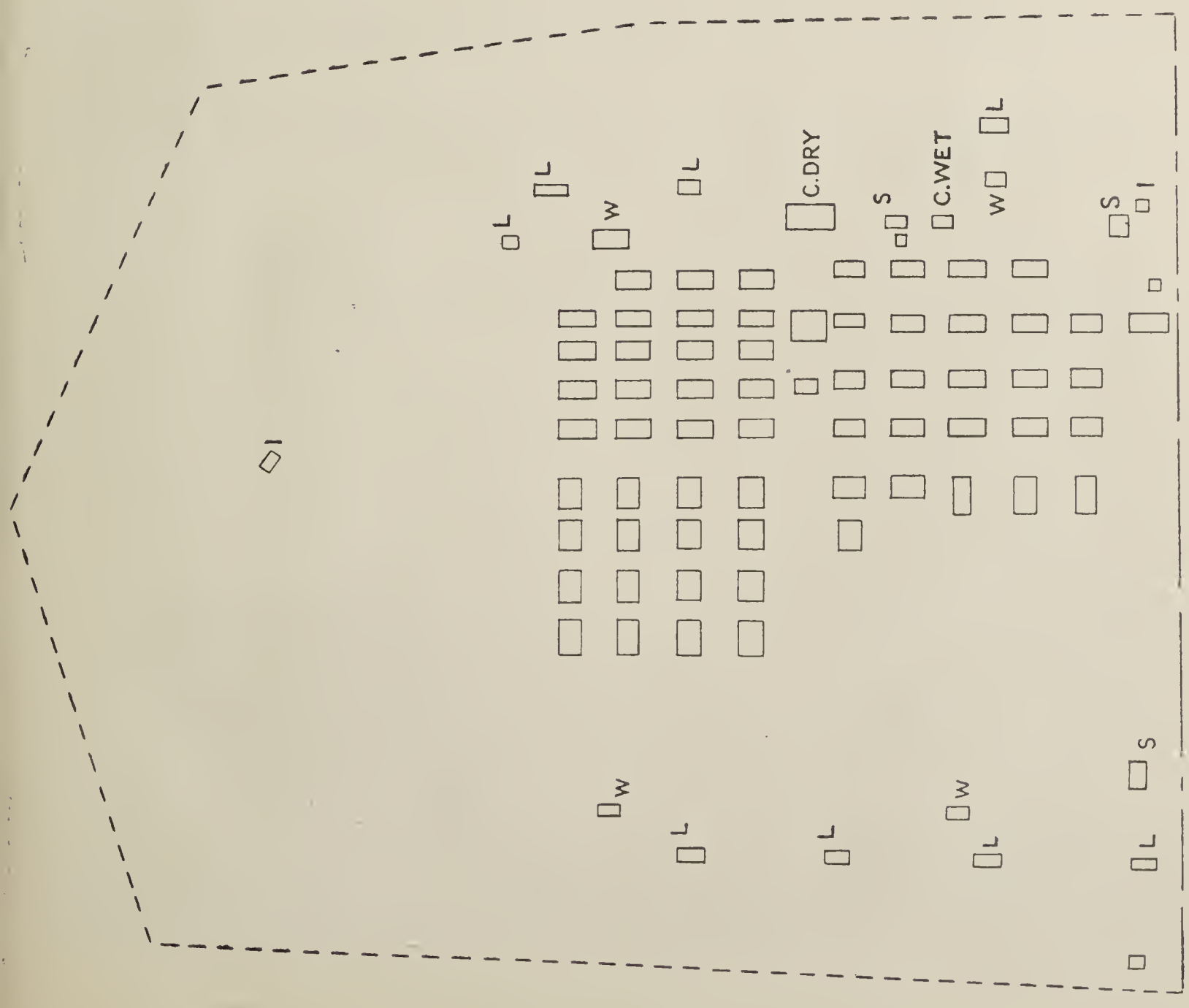
MOSQ.



NUMBERING OF HUT & ROOM

HUT 16
ROOM 4

TYPE OF DISC USED



W. = WASHING PLACE I. = INCINERATOR L. = LATRINE
S. = STORE C. = CANTEN

RESUME OF OEDEMA CASES.

Hut.	Room.	Occupants.	Animals.	Bed.	Hut.	Room.	Occupants.	Animals.	Bed.
4	2	M	D	S1	14	2	F		S1
	4	M F	D	S1		4	M F		U2
5	2	M		S1		7	S		U2
	7	M		U1	15	2	M F		U2
7	2	M		S1 U1		8	M	D	S1 U1
	3	M			16	7	F	P	S1 U1
	4	M	D	S1 U1		8	M		S1 U1
	5	M		S1 U1	17	3	F		S1
8	1	M	D	S1 U1	18	5	M		S1 U1
	3	M CM		S1	20	1	F	D	S1 U1
	4	F	D	S1 U1		4	M		S1
	6	M	D	S1	21	1	F		S1
	7	F	P	S1		8	F		S1 U1
9	1	S		U2	27	3	S		S1
	3	F		S1 U1		7	F		S1
	5	F	D	S1		8	S		S1
	6	M	D	U2	28	6	FF		U1
	7	M		U1	30	3	M F	D	U1
	8	M		S1	33	5	F		U1
10	2	M		S1 U1	35	5	F		U1
13	3	M		S1	39	5	F		U2
	4	M F		U1	40	3	M		U1
14	1	M		S1 U1	47	2	M		S1 U1

S1=1 Screened bed U=Unscreened.
M=Adult male ; F=Adult female ; CM=Male child ; S=Servant D=Dog ; P=Fowls.

The Œdema Cases.—The serious cases of œdema were admitted, some to the Connaught Hospital but others chiefly to the Hospital at the Barracks, where they were treated along several lines to find, if possible, an efficient remedy. In the Barracks' cases the diet was kept unaltered and consisted of rice seasoned with red pepper, palm oil and, occasionally, with the addition of a small piece of beef or fish.

The patients treated at Connaught Hospital will be considered below.

The other patients and early cases were grouped as ambulatory subjects in experimental classes and various prescriptions were given each group, with the possible object of obtaining better statistical data concerning treatment.

Ambulatory Cases.—I am submitting a list of these groups showing the number of ambulatory patients in each, the prescriptions used and the result of treatment :

Group.	Number.	Sex.	Prescription.	Medicine Number.	Result.
1	4	3M 1F	Calc. Lact. gr. 10 Aq. Menth Pip. oz. ss T.I.D.	1	One improved—fifteen days three not improved ; given medicine No. 2 then clear in ten days.
2	5	3M 2F	Calc. Lact. gr. 10 Mist Alb. oz. ss T.I.D.	2	Well nine to thirteen days.
3	5	3M 2F	Mist Alb. oz. ss T.I.D.	3	Well sixteen to twenty days (one to Kissy—smallpox).
4	4	3F 1M	Calc. Lact. Sod : Citrat aa gr. 10 T.I.D.	4	Well twelve to fourteen days (slow at first-rapid later.)
5	4	2M 2F	Ferri Tonic ss oz. T.I.D.	6	Not improved ; eighteen days rapid after medicine 2 and 4.
6	4	4F	Tr. Digital M5 Calc. Lact. gr. 5, Ferri Tonic dr. 2 Aq. Ad. oz. ss T.I.D.	8	Not improved ; eighteen days (1 improved) put on medicine 2 and 4 and rapidly cleared.
7	4	1M 3F	Sod. Citrat gr. 10 Hexamin gr. 5 Tr. Digital M 5 Syr. Aurant dr. 1. Aq. Ad. oz. ss T.I.D.	9	Not improved after 18 days one improved after 14 days given medicine 2—improved.
8	4	2M 2F	Calc. Lact. gr. 5 Ferri Tonic oz. ss T.I.D.	11	One improved. 15 days others no improvement given medicine 4 improved.

(Mist. alb. is a white saline purgative mixture containing Magnesium oxide Magnesium Sulphate and Peppermint Water. Ferri Tonic contains Iron Citrate, Quinine and Strychnine).

All these subjects were given medical treatment daily for an observation period of eighteen days and the results were noted. They remained on the same diet to which they had been accustomed and no new rice was allowed, nor was there any special issue of foods rich in vitamin B. If improvement did not follow within eighteen days the subjects were switched over to a line of treatment which had been proved to be successful for other groups. Thus, in some classes, no betterment was observed, in fact, many patients became worse but when given the "Calcium Lactate Purge" mixture or calcium lactate and sodium citrate, they all cleared up rapidly in ten to twelve days. No fatal issue attended the experiments although many ambulatory subjects had well defined œdema.

During these group tests, two cases contracted chickenpox and had to be removed for observation to the Kissy Male Isolation Infirmary.

Hospital Cases.—Generally, the patients treated in the hospital cleared up more rapidly due to the rest in bed and to the better conditions of warmth and shelter maintaining in the building.

HOSPITAL CASES.

Group.	Number.	Sex.	Prescription.	Medicine Number.	Result.
9	5	M	Calc. Lact. gr 10 M Alb. oz. ss T.I.D.	2	All improved 7-10 days
10	5	M	Enema Simplex (once daily)	10	„ „ 12-14 „
11	4	M	Calc. Lact. Sod. Citrate aa. gr. 10 Ferri Tonic oz. ss T.I.D.	5	„ „ 15-26 „
12	4	M	Calc. Lact. gr. 10 Salol gr. 5 Sod. bicarb gr. 15 T.I.D.	7	Not improved after 16 days— given purge in addition and cleared in 7 days.

The food of these patients was what they had been having in their huts at the Barracks' Compound, where it was prepared and then brought over to them. They each consumed daily about $1\frac{1}{4}$ lb. rice, cooked with the addition of red pepper as curry, palm oil (about 2 ounces) and some dry fish.

Very few of these patients received beef every day but they all had it twice a week. On other days the protein was obtained in the form of dried fish. In general, as far as protein-rich foodstuffs is concerned, the average soldier lived on what may be colloquially termed the "Hunger and Burst" principle. The meat ration is reduced to a minimum till the week-end and, especially, till pay day at the end of the month, when, at Wilberforce Barracks, extra cattle are killed to supply the market demand. It was fortunate that the majority of the hospital cases did not receive the surfeit of beef during stay in the hospital. As will be shown later, excessive amounts of meat have a peculiar influence on the course of the disease, in that the œdema tends to be reduced with a diet rich in animal protein. This aspect of the condition was confirmed by observations on the inmates of Freetown Prison.

Treatment Survey.—Surveying the treatments, it was considered that, to be successful, it was necessary to include calcium lactate, preferably made easily assimilable by exhibiting also the alkaline effect of sodium citrate and to add an efficient saline purge. Although, however, this calcium lactate and purge treatment made the œdema vanish and enabled the patient to feel well and to be able to resume duty, it cannot be considered a cure provided the subject continues to eat faulty rice. So long as this type of treatment is taken, the rice could be consumed without any considerable increase of the œdema following, entirely, I think, because of the purging effect of the saline and of the vaso-tonic influence of the calcium salts. When the treatment was withheld the dropsy returned in about eleven days and it was always preceded by a bout of constipation. On the other hand the treatment effected a permanent cure of the condition after six months, when the men ate new season's rice, even despite the onset of attacks of constipation or when the "œdema-producing" rice was cooked as I directed.

Distribution of Cases.—Concerning the distribution of œdema among the entire Colony at the Compound, I have submitted below a table to demonstrate the age and sex incidence:

Total Cases	...	54	Men	...	30:226	3.3 per cent.
„ Population	...	554	Women	...	19:185	10.3 „
„ Incidence	...	9.7 per cent.	Servants	...	4:63	6.3 „
			Children Boys	...	1:31	3.2 „
			„ Girls	...	0:49	0.0 „

Among the entire inhabitants, the incidence of œdema was 9.7 per cent. with a sex and age distribution as shown above.

That the soldiers are exposed to the strain of physical training, to drill in comparatively heavy equipment and to strict discipline are potential causes of the high relative incidence of the condition among their numbers. Women do not lag far behind in that they have fairly hard work to do washing clothes and preparing rice by pounding in the native mortar with heavy wooden pestle. The boys (servants) come under a special category. Some are attached to the native soldiers and others to the European Officers. Among the latter no œdema was observed; whether or not this is due to the lavish treatment by their employers or to the enhanced opportunity of participating at a better commissariat is unknown, suffice it to remark that none of these boys showed any signs of chronic starvation and they did not eat the same rice as was consumed by the soldiers.

The female children, by a close association with their mothers, are better looked after than the male children. This may be the cause of their increased resistance to the condition.

Multiple Infection.—Infection ought to be considered in terms of multiple infection, where two or more people in the same room exhibit the sickness at the same time. Forty cases were found in rooms occupied by more than one individual, yet, although the total number of occupants of these rooms amounted to ninety-eight only seven cases of “dual” infection occurred.

Of the forty, thirty-three were married people but of these only five couples were found to be suffering at the same time. In one case a man and his child were affected and in another two of three sisters, so that in all, seven instances of “dual” infection were displayed or that the disease affected only fourteen people, who were daily in the closest contact with their neighbours. During any part of the work there was no indication of one individual being affected and a neighbour later after a definite incubation period. This idea of infection by contact and by vectors had carefully to be considered because of the peculiar suspicion of an infective agent in the Prison cases. It will be brought up again later.

Effect of Mosquito Nets.—That the condition may have an insect vector had to be investigated. In this light the influence of screening by mosquito nets was taken into account, but apparently these have no effect at all on reducing the incidence of the disease. From the census it was observed that slightly more than half of the personnel does not possess nets (211 unscreened 197 screened beds) but this factor must be reduced to terms of the œdema cases only. Among these it will be observed that almost all their rooms possess screened beds. This would at once suggest that there was ample protection because thirty-two rooms were so equipped out of a total of forty-six. The sleeping arrangements of the African soldier requires explanation. Generally, the soldier himself has his bed provided with a mosquito net and his wife can struggle along as best she can; so that the screen distribution becomes somewhat altered. It works out among the patients in the following ratios.:

					Screened.	Unscreened.
Male	...	...	...	...	24	10
Female	...	...	...	...	6	13

In other words, thirty of the fifty-three cases were protected and in the habit of sleeping under nets. They did not complain of mosquitoes, which admittedly were comparatively few, but all made reference to the prevalence of bedbugs.

The theory of an insect vector merits further attention, when the loci of the disease are considered along with the plan of the Compound. The bulk of the cases was confined to Huts 4, 8, 9, 13 and 14, which are all situated together. The possibility of an insect vector disease became apparent, but as the work progressed, it was partly relinquished in view of the theory of rice poisoning expounded later. After all, even allowing the chance of a disease being carried, these people were all, more or less, eating the same food which, if proved to be toxic, would eliminate at least the necessity of an insect borne disease. It is considered superfluous to promulgate theories of infection and of insect vectors, if in a mass attack all the members of a community partake of the same type of food; which is shown to be detrimental to health.

Pets.—Not much cognisance ought, I think, to be taken of any part played by animals kept as pets. Fifty-three dogs roamed the Compound, together with many fowls, all of which share the shelter of their owners. Guinea pigs are quite commonly kept, but, in no case, were they associated with an “œdema” subject. Eleven patients had a dog each and two kept fowls. During the owners’ sickness and after their recovery, the animals continued to share the amenities of the household without any detriment to their owners or to themselves. These animals did not show evidence of any disease process.

Rice at Wilberforce Barracks.—At the time of the outbreak, I examined, in conjunction with the Superintendent of Prisons, specimens of rice supplied to the Royal West African Frontier Force. The samples had a musty smell. I found the rice to contain a high percentage of old, dead and fungoid-diseased grain (29 per cent.) and to be mixed with a small percentage of bored and broken grains. Weevils, rice bugs and maggots were present. A large percentage of the rice showed black and dark brown discolouration, extending from the pericarp inwards to the starch.

The soldiers complained that when they ate this rice they suffered from colic and abdominal trouble, some with constipation, others with diarrhœa.

In all cases of œdema at Wilberforce Barracks, there was a history of gastro-intestinal stasis occasionally with colic.

Effect of washing Rice.—To make it a safer food, I recommended that the rice be cleaned in water and cooked in a special manner. This consists of washing thoroughly in cold water, placing the rice in a pot with water to cover, just bringing to boiling point and throwing away the yellow-brown boilings. Fresh clean water is then added and cooking is continued till the rice is soft and edible. By these means it is maintained that soluble toxins are dissolved and thrown away but any vitamin B is retained undestroyed.

A number of women in the Compound had been using this method before I recommended it and in no case was any of their family circle affected. On the other hand, in every case of œdema, although quite a number washed the rice in cold water before cooking, all invariably conducted the cooking of the rice by adding just sufficient water and boiling till the grain had softened and absorbed all the water. There was no mention of throwing away the initial boiling water. Recovery from the œdema became permanent when this method was adopted.

One case is of special interest in this consideration. A Patient (A) had been admitted to the Barracks Hospital and treated with Calcium Lactate and Sodium Citrate. In the hospital he shared the rice of another patient (B), a case of Bronchitis, whose wife threw away the first boilings. Both men recovered and returned to duty but a fortnight later (A) was readmitted to the hospital where he informed the dresser that he had gone back to his own wife’s method of cooking, in which all the water was boiled into the rice. (A) recovered and did not show any relapse to the œdematous condition, when he consumed the rice after the initial boiling water had been rejected.

Previous Outbreaks.—On account of the difficulty of obtaining accurate data, any reference to previous outbreaks of œdema at Wilberforce Barracks is scanty. The daily record of medical complaints was gone over for the last three years in the hope of gleaning some such information and the results, as well as could be ascertained, for that period, are tabulated and submitted below.

The total number of complaints per month was noted, together with the general prevalence of constipation, rheumatism and œdema. To ensure a small degree of accurate co-relation the notified diseases are all brought to terms of daily incidence, allowing for the numerical daily variation in the month. Unfortunately, however, the figures appertaining to the movements of troops were not available in order to make an absolute index of the daily notification of disease. On this corrected value the percentage incidence of the complaints of constipation, rheumatism and œdema is calculated. The table shows the quantity and the dates, as far as could be ascertained, upon which rice was delivered to the Quartermaster of the Troops.

WILBERFORCE BARRACKS.

MONTHLY SICK RETURNS FOR YEARS 1929-1931.

Month.	Total.	Cons.	Rheu.	Oed.	PERCENTAGE DAILY INCIDENCE.					
					T. & D.	Cons.	Rheu.	Oed.	Rice (Bushels.)	
1929.										
January	145	17	10	—	4·677	·3781	·2224	—		
February	65	15	1	—	2·321	·8241	·0549	—		
March	106	11	7	1	3·483	·3285	·2096	·0229		
April	135	30	10	—	4·500	·7409	·2470	—		
May	105	12	7	—	3·387	·3687	·2700	—		
June	100	8	9	2	3·333	·2667	·3000	·0667		
July	165	34	10	5	5·323	·6646	·1955	·0977		
August	242	41	18	2x	7·805	·5465	·2399	·0266		
September	155	25	13	2x	5·167	·5376	·2796	·0430		
October	161	20	13	—	5·192	·4007	·2604	—		
November	174	18	12	1	5·800	·3449	·2300	·0192		
December	71	10	8	—	2·290	·4542	·3634	—		
1930.										
January	79	5	8	—	2·548	·2042	·3265	—		
February	139	25	11	—	4·963	·6423	·2826	—		
March	157	25	11	1	5·063	·5136	·2260	·0205		
April	142	34	11	—	4·733	·7981	·2583	—		
May	213	60	7	3	6·870	·9087	·1060	·0454		
June	261	48	23	—	8·700	·6130	·2937	—		
July	141	6	13	—	4·547	·1373	·2973	—		
August	105	4	1	—	3·387	·1230	·0307	—		
September	109	7	9	—	3·633	·2141	·2753	—		
October	181	19	15	1	5·838	·3386	·2673	·0178		
November	146	10	12	1	4·868	·2283	·2740	·0228		
December	140	15	9	—	4·515	·3456	·2073	—		
1931.										
January	53	9	3	1	1·710	·5476	·1825	·0608	5th—200	
February	136	16	4	3	4·857	·4202	·1030	·0788	5th—480	
March	258	25	26	1	8·322	·3125	·3251	·0125		
April	133	22	17	1	4·434	·5548	·4250	·0251		
May	92	7	13	2	2·968	·3089	·4557	·0701	20th—200	
June	99	5	14	—	3·300	·1684	·4714	—	6th—200	
July	93	11	12	2	3·090	·3815	·4162	·0693	17th—200	
August	84	6	10	1	2·710	·2304	·3840	·0384	16th—400	
September	98	6	18	1	3·267	·2041	·6123	·0340	19th—200	
October	137	10	14	11	4·410	·2554	·3288	·2590	23rd—200	
November	126	10	13	14	4·201	·2646	·3438	·3704	29th—112	
December	89	10	9	3	2·805	·3621	·3262	·1087	2nd—200	
									250	

Cons=Constipation.

Pheu=Rheumatism :

Oed=Oedema.

T. & D.=Monthly total + number of days in month.

X=Outbreak of complaints of "sore feet "

Factors to correct for movement of troops not available.

The results of these data are depicted graphically. On the same scale the variations of rheumatism, constipation and œdema are shown, while on a smaller scale, is a graph depicting the daily incidence of all notified diseases.

It will be seen that, although there is a fairly constant relation between constipation and œdema (constipation always preceding œdema), the same does not necessarily apply to rheumatism. This may be merely a question of nomenclature. The terms myalgia, rheumatism, lumbago, sciatica, fibrositis, muscular and joint pains have all been employed and it is difficult to know if previous Medical Officers considered rheumatism in the narrow sense of "joint pain " or if they imply the aspect mooted by Professor R. Stockman of Glasgow University of a disease essentially of overgrowth and inflammation of the fibrous tissue, no matter where disposed this essential packing tissue may be.

In general, Drs. Leitch and Watson's (2) work confirms these observations on the correlation between rheumatism, œdema and constipation, although they do not indicate that gastro-intestinal disturbance may be a forerunner of Beriberi œdema.

I am told, too, that the late Dr. Young commented on the correlation between gastro-intestinal disturbance and dropsy, when he was Medical Officer at Freetown Prison.

Mr. Biddle's experience, also, is most helpful. He states that he does not remember having seen a case of Beriberi which was not preceded by a history of gastro-intestinal upset, taking the form of constipation and later of diarrhoea.

The Supply of Rice.—In the table above I have submitted data concerning the dates when rice was supplied to the Royal West African Frontier Force, but, although I found diseased rice at the Quartermaster's Store, I am unable to state which of these consignments were faulty. Reference to the supply of rice to all the affected centres will be made by Dr. McDouall.

The last epidemic had been present at the Freetown Prison and at Kissy about August 1931, but it did not break out to any extent among the Royal West African Frontier Force until early October 1931, when it rose rapidly to a peak value in November and steadily declined. It has since disappeared (January 1932). From information received from Mr. Biddle, there definitely was an issue of diseased rice to the Royal West African Frontier Force in July 1931. Any inferred incubation period cannot, however, be set because the troops drew this rice from the Quartermaster's store as required, therefore, of necessity, the stocks held by the soldiers were of variable amounts. Good rice has since been issued to the troops and no new cases of œdema have occurred.

Outcome of the Work.—The inhabitants of the Wilberforce Barracks Compound continue their simple diet of rice, palm oil, pepper, curry, with an occasional portion of fish or beef and a small amount of fresh fruit. No added vitamin products like Bemax, Marmite, yeast, cod liver oil are taken with the food. They live an open air life on an exposed part of the country. Essentially, their conditions are the same as they were during the outbreak of œdema, yet merely by changing the rice and/or method of cooking, œdema has been reduced here to the vanishing point by employing these simple means and by ensuring that, through the Quartermaster's Department a supply of good sound rice is issued to the troops.

All the patients who contracted the disease during the last epidemic have since been examined at intervals and found to be well. There is no evidence of permanent injury in the way of œdema, cardiac disability or nerve changes. In my opinion, this cannot be claimed simply as a victory for treatment by Calcium salts and by purging alone but I consider that it is of foremost importance to ensure that these people are supplied with rice in good condition and not showing signs of deterioration.

KISSY ASYLUM.

During the enquiry, this institution was under the charge of Dr. Easmon, who kindly assisted me, as far as possible, with statistical data concerning the condition at the Asylum. There was no history of any previous outbreaks but during the present epidemic no less than twenty deaths occurred from August to December, 1931.

Although I was responsible only for the post-mortem examinations and I performed the majority of the necropsies, I made a few observations on the housing conditions and on the diet of the inmates.

Accommodation.—The majority of the patients were accommodated in large wards with beds the regulation distance apart and without overcrowding. The clothing and bedding were clean and did not show signs of verminous infection. The walls of the wards were made of a mud-cement composition, parts of which had been broken in places. No bedbugs were found. There did not appear to be evidence of any patient having the infection carried from his immediate neighbour, as will be presented in cases which occurred at Freetown Prison. In general, the inmates were clean and showed signs of kindly treatment and good care.

Dietary.—At the same time I visited the kitchen of the Asylum and inspected the rice bin, where there was stored a quantity of rice containing old fungoid grains, bored and broken grains and discoloured grains. Weevils and maggots were seen in the bin. This rice contained on examination 33 per cent. of pericarp as shown by the Vedder and Feliciano method (3). The rice was supplied from the Freetown Prison and came from the same source as was used in Freetown Prison and Wilberforce Barracks.

The inmates of the Asylum had their rice cooked in a large open boiler, into which the grain was placed, water added and boiled for the specified time of twenty-five minutes as laid down in the instructions of Drs. Leitch and Watson (2) (pp 91 *Report on an Investigation of Beriberi at Freetown Prison*). Any surplus rice water was not

discarded but was added to soup, although the cook informed me that generally the water more or less all boiled into the rice. During the epidemic there was no doubt that Dr. Easmon relying on the diagnosis of Beriberi due to avitaminosis did all in his power to cope with the condition by allowing a most liberal diet, high in calorie value and excessively rich in added vitamin products. This had not the slightest effect on the course of the epidemic.

Observations.—In the course of my duties, I interviewed several inmates. In November I found eight cases of œdema most of whom came ultimately to necropsy before the year ended.

On enquiry, I learned the treatment consisted of a very liberal diet of rice, greens and meat, with Marmite as an additional source of vitamin B. To the patients suffering from pericarditis a cardiac mixture, called “Mist. Beriberi” was exhibited. This had been advised by Drs. Leitch and Watson (2) and was compounded from the following prescription:—

Tr. Belladon.—m XX

Tr. Strophant.—m III

Tr. Digital.—m V

Tr. Nuc. Vom.—m V

Mag. Sulph.—dr. I

Aq. Chlorof.—ad oz. I.

Unfortunately, in all the cases I saw, it did not have the desired effect, even when coupled with large doses of vitamin B (supplied in the form of Marmite). However, as my duties did not extend to treatment of the cases, the observations I made at Kissy Asylum, where the outbreak was very serious, were confined to post-mortem examinations and records of the necropsy findings are given below in the Laboratory Results.

CONNAUGHT HOSPITAL.

In the light of scientific research and considered as a suitable experimental subject from whom reliable data may be obtained, the African out-patient at this Hospital is utterly unreliable. He has no conception that his condition may be but the reflection of a train of past occurrences, including the detrimental influences of exposure, lowered resistance, faulty diet, verminous housing and clothing, implicit faith in native applications and “magic” medicine. He has an inborn dread of hospital, which is displayed in his over anxiety to get away from the wards whenever he feels just the slightest improvement and not to return to hospital, if possible. Women are worse in this respect, in that when their sick children are brought to the hospital, often in extremis, they are removed at the earliest onset of recovery, often considerably to the detriment of the patient. The outcome of this mentality is that on any particular disease, unless it be of an entirely incapacitating nature, research is of no great value because the final results are not seen. One has to assume that in 80 per cent. of the cases, if the patient does not return, he is well or sufficiently recovered to be content with a course of native medicine. Therefore, when making the study of œdema, although it was deemed useful to employ the Out-patient Department of this hospital, the Department was used almost entirely as a clearing and sorting house, from which treatment could be given to ambulatory cases and from which “interesting” cases could be transferred, if possible, to wards in the hospital.

Out-Patient Department.—In November, 1931, many cases of œdema cropped up at the Out-patient Department. They displayed the same signs as were present among the troops and among the prisoners at Freetown Prison. Oedema of feet and legs was commonly coupled with a history of chronic constipation. The urine showed no abnormalities but had an excessive amount of “earthy” phosphates, which in these cases, may have been due to reduced water intake with the concomitant result of higher concentration of urinary salts. Many had præcordial distress and breathlessness. In one man, a pauper, who had been consuming black mouldy rice, œdema of the abdominal wall and of the skin over the sternum was found in addition to dropsy of the lower limbs.

All the cases were requested to furnish samples of the morning urine and of the rice which they generally had been using. Thirty-six cases in all were observed.

One young girl (aged twelve years) brought a new sound rice, which turned out to be recently purchased, as she did not like to show the old rice which she had been eating. Two patients, sisters, had been for several months eating parboiled rice, in which the grain was large and white with no pericarp remaining. They were treated as cases of true Beriberi avitaminosis. They were given cod liver oil, fresh tomatoes and other fruits and advised Bemax, upon which the condition slowly abated. They became perfectly well after eight weeks treatment, but it was learned they had commenced to eat, during the course of their treatment, new season’s rice, of which they brought a sample. It was not parboiled and contained 58 per cent. pericarp.

A fourth subject was admitted to the hospital as a case of dry Beriberi. He had been serving on board a ship on which he stated old rice had been issued. He improved on a full diet of bread, butter, meat, fish, eggs, milk, potatoes, fresh fruit without additional accessory food substances and he was discharged with complete recovery four weeks later.

In the remaining thirty-two cases treated, all the rice samples examined were of poor grade, containing discoloured grains, fungoid grains and signs of weevil activity. These subjects were all treated by the Calcium Lactate and purgative method and all cleared up within twenty days of treatment; at least after sixteen days they showed considerable improvement, had their mixture repeated and did not report again, except for four cases whose improvement was sluggish but positive and who disappeared after twenty-eight days under casual observation.

All these subjects in the Out-patient Department were advised about rice and cooking and most of them stated they used up their rice stock by altering the cooking.

In-patients.—Twelve cases were admitted for observation to Ward No. 2. Urinary examination in all cases but one revealed no albuminuria or other of the customary abnormalities but at first all had excessive phosphates. The one exception was a case of subacute nephritis with albuminuria and casts. In the remaining eleven, there was a constant history of chronic constipation, rheumatic pains, slight palpitation and breathlessness on exertion, tender calf muscles and œdema of the legs to the middle of the thighs. Ten had partial anaesthesia (loss of heat, tactile and pain but not of cold) over the pretibial area. The remaining one had diminished sensation only to touch and temperature, pain being present. The tendon reflexes were variable. On admission, they all had slightly elevated blood pressure (average systolic 152–164 mm. diastolic 90–106 mm.) and with the rest in bed and treatment this was steadily reduced (systolic 128–142 mm. diastolic 80–84 mm.) Two cases complained of difficulty with vision and of photophobia. One had increased intraocular tension and signs of early glaucoma, which, however, cleared up on treatment.

The diet was standard for all these patients, termed “full hospital diet,” which was composed of rice, greens, beef, tea, sugar and dry bread (except with two enemata patients whose rice was disallowed and replaced by potato and bread). The medical treatment was grouped as at the Wilberforce Barracks Hospital:

Group.	Number.	Prescription.	Result.
(a)	2	Calc. Lact. gr. 10 Ferri Tonic oz. ss T.I.D.	Improved seventeen days.
(b)	4	Calc. Lact. gr. 10 Mist alb. oz. ss T.I.D.	Improved five to twelve days.
(c1)	3	Enema (simple) twice daily (including the pauper with sternal œdema)	Improved seven to nine days.
(c2)	2	Enema (no rice diet—potato and bread).	Improved eight days.

Results. These eleven patients reported in one month after discharge and all remained normal, except one, who had been unable to purchase good rice or to have his food properly cooked. He received a prescription for Calcium and Mist. Alba. but he did not return to report his condition.

Reverting to the Connaught Hospital groups (a), (b) and (c), it was shown that in:

- Calcium Lactate and Ferri Tonic there is a tendency to constipation which is considered to be responsible for the delayed recovery.
- Calcium Lactate and purgative act almost as rapidly as simple enemata but at Connaught Hospital the recovery period is faster than at Wilberforce Barracks, where the diet is of poorer quality and less liberal.
- The enemata results are of interest. These subjects were allowed (group C—1) the same diet as the others in groups (a) and (b) but they had twice daily a simple water enema without soap, using a quart of water each time. Copious foul-smelling results were obtained at first with hard inspissated faeces. After four treatments the washings were returning clear, except with traces of mucus. The odour had almost gone and the patients were looking obviously improved. The expression was brighter, the eyes less sallow and, most annoying of all it was with difficulty that they were persuaded to remain in the hospital, possibly an aftermath of the strenuous treatment. In group (C—2 enemata and diet, with rice replaced by bread and potato) the speed of recovery was the same. Apart from the interest of this result, no opinion was voiced till more records were made at Freetown Prison under the same conditions.

The clinical observations made on the patients are mentioned in the Laboratory work to avoid recapitulation.

Infectivity.—In the early cases at Freetown Prison there appeared phenomena that indicated infection of one man by another, a point to which reference will be made later in connection with Freetown Prison. This has already been considered above under “insect vector and multiple infection” at Wilberforce Barracks. The Connaught Hospital cases, on no occasion, showed any infectivity to their immediate neighbours, despite the presence of fleas and other possible insect vectors. On each side of the Oedema cases were placed such conditions as pneumonia, malaria, dysentery, phthisis, yet despite these enfeebling conditions, none developed the disease, even with prolonged stay in Hospital after the oedema cases had gone.

It is natural to adduce that in these observations at Connaught Hospital, the variable factors are too numerous and this fact is at once conceded. These patients, unlike those in institutions or at the Barracks, have not only medical treatment, but, what is infinitely more important, a complete change in dietary, which, undoubtedly, accounts for all of them clearing up so rapidly. I consider, however, that the treatment by purging enables a more rapid elimination of any intestinal toxin, which may be producing the disease, or, at least, hindering the recovery. There is to be considered, too, the relative recovery rates, which are faster when purging is undertaken. One point, I think, must be allowed, and that is, the success of the treatment does not depend upon the addition of copious quantities of vitamin B, as would be considered necessary, were this oedema entirely due to lack of this accessory food substance.

Allied Complaints.—At the Out-patient Department I undertook observations on the incidence of Myalgia, with rheumatic pain of the limbs and its possible association with avitaminosis, oedema and Beriberi of the dry neuritic type. The subjects, however, proved so utterly unreliable that this work at the Connaught Hospital Dispensary was discontinued.

While in charge of the Out-patient Department at Connaught Hospital, a student of the Wilberforce Training College was brought, suffering from “A” avitaminosis (as described by Dr. Wright) (4). She was treated by calcium and cod liver oil and malt with complete recovery in two months. At that time I visited the Wilberforce Training College and requested to be shown the rice store in which were found old fungoid rice, discoloured and broken grains and weevils, but no maggots were seen. At that time I was shown three other cases of early avitaminosis. They were not put under any treatment, but advised merely to keep the intestinal tract cleaned out and to eat good rice. The new rice was the chief dietary change effected. When three months later, I visited the College, I learned that all the cases of “A” avitaminosis had cleared up and that the girls were in good health. At the time it occurred to me that this institution was a new ground for dietary investigation.

FREETOWN PRISON.

Oedema has been present in the Freetown Prison for at least the past forty-eight years and notifications have repeatedly been made to vague outbreaks of a condition of dropsy with dysentery. It has been only within the past few years that the disease has been labelled “Beriberi,” especially when the final stages of the condition have been observed. Recently the work received intensive study in the hands of Professor Blacklock (1) (1922) and Drs. Leitch and Watson (2) (1929).

Previous Work.—Mr. Biddle’s observations are those of the layman, unbiassed in outlook and unsteeped in the lore of medical diagnosis. As such, I think they have to be considered with respect, especially also, as he has had constant contact with the disease for at least eighteen years. He has remarked that all the epidemics occurring at the Prison since 1914 have invariably been preceded by gastro-intestinal symptoms, chiefly of a dysenteric nature.

The particular casual agent, whether bacterial or otherwise, has never been determined with any measure of success and, although equipped for bacteriological work in the Sir Alfred Jones Laboratory, Drs. Leitch and Watson (2) were unable to track down any organism to which might be attributed the disease. They refer to one case, in which they found only the common organisms (*B. coli communis*, *B. megatherium*, *B. friedlander* and *B. morgani*) to which none of the pathological findings were attributed. They came to the conclusion that this disease was definitely due to “B” avitaminosis.

The Superintendent of Prisons makes a valuable observation, in that, if within a few days after the Beriberi had been diagnosed, the patient developed a mild attack of diarrhoea, he usually died, whereas all the cases who suffered from a prolonged and severe attack of dysentery recovered from the Beriberi condition. These curious phenomena had also been commented upon by Dr. Butler in 1914 and the late Dr. W. A. Young in 1919. Young went the length of isolating every person on admission until he was proved free from infectious disease. In view of the purging effect of the treatment I adopted at Wilberforce Barracks, and at Connaught Hospital, this observation is of great interest, in that a similar absence of intestinal stasis is the net result both of treatment by purgatives and of chronic dysentery.

Theory of Infection.—Commenting on the possibility of an infectious disease, the Superintendent of Prisons states that during the last epidemic (1929) the first patient was an Assistant Warder, Lamina, who was in charge of the Carpenters' workshop. He died after about ten days sickness. The next case, also fatal, was a prisoner, Sandi, who worked under Lamina's supervision.

When the epidemic was almost at a peak, another Warder, Yamba, took ill after he had been allocated duty at "D" block, where the majority of the cases were under observation. In this subject a long history of dysentery of two months duration was noted and, although he made a remarkable recovery, he was no longer fit for the service.

Continuing his observation, Mr. Biddle makes note of a prisoner, Abu Lemberg, who had been recommended for the radical operation for double hernia. On account of his poor state of nutrition, he was admitted to the Hospital and allowed a liberal diet. His physical state became so much improved as to enable him to be fit for the operation but, just at that time, two epidemic cases were admitted to the Hospital and confined to beds on either side of his. A few days later, in spite of his most liberal diet, including tomatoes and other fruit, Abu Lemberg developed the disease from which he managed to recover.

Mr. Biddle makes reference to the large number of cleaners who suffered during this (1929) epidemic. Although normally eighteen are allocated to the task of removing, emptying and cleaning the commodes of the entire Prison, the incidence of cases in this section was very high, as instanced by the fifty-six who suffered in a population of 218 men. It was considered that there was a grave risk attached to this work and even the men themselves had the impression that it was of a deadly nature. The Superintendent of Prisons tells me of one man, who belonged to a particular group under survey, and to whom this task was allocated. The prisoner did not remonstrate but merely remarked to Mr. Biddle that if instructed to do so he would perform the job but "he go die." A short time later the man fell ill with the epidemic sickness and succumbed. However, this may have been but an example of the native's fatalism.

On their face value these incidents would appear to support a theory of infection but sight must not be lost of the point that all the men were participating in the rice common to everyone's diet and that the cleaners, who suffered most, also had the hardest physical work to perform, which might possibly be sufficient to overstep the low threshold that the average African Native shows towards disease. Hard physical exercise had been recommended in the treatment, an outcome of the theory (Leitch) that œdema attacked chiefly the sedentary workers. Many untoward and fatal consequences have resulted following this advice.

Coupled with the case of Abu Lemberg are the following two incidents to display that, despite the diet rich in vitamins and of high calorie value, the spread of the disease was not retarded by taking care of calories and vitamins alone.

Prisoner V. Caulker had had, over a long period, an extra ration of one pound of bread and one pint of milk in addition to his ordinary full diet, yet he was badly affected.

Prisoner Sherka was granted extra bread (one pound daily) on account of his old age but he, too, developed the disease.

When I took over the Research in November 1931, my work did not permit of treatment or of intensive experimental observations on the patients, who were under the control of the Medical Officer in charge of the Prison and the time had to be devoted to such aspects as were included in the biochemical and biological research. In the early stages, my work consisted of collecting samples of rice, pericarp and dust and of observing the food of the prisoners.

The Rice Mill.—Freetown Prison possesses the only power mill in the Colony and all the rice used by the prisoners is treated here. From the contractors it is supplied as "paddy" or rice in the husk which, before being fit for use, is cleaned by the mill, decorticated and polished partly to remove the pericarp. The end products of milling are husk, powdered pericarp and cleaned rice, polished to any desired degree. There is a very large amount of dust in the atmosphere at this mill. This dust was collected from the walls and from the machine parts for analysis. On the whole, no sand was present among the fine floating particles. It is found chiefly in the deposit of pericarp dust in the mill and some with the husk deposit.

As many complaints of bronchitis, sore throat and gastritis are made by the prisoners who work the mill, they are supplied at the end of each shift with stimulating cough mixture. The expectorated sputum contained small particles of rice cortex with pericarp dust embedded in the desquamated pulmonary epithelial cells. Had silicosis been present, sand particles would have been anticipated in these macrophage cells, but none were found. Phthisical sputa were not found.

The Diet of the Prisoners.—The diet recommended by Drs. Leitch and Watson (2) was drawn up expressly for its anti-beriberi value and its high calorie value. It virtually replaced the old statutory diet. I have tabulated the diet below recommended by Drs. Leitch and Watson.

Foodstuff.				Weight of Ration.
				Ounces.
<hr/>				<hr/>
5.30	A.M.—Cocoa	..	...	$\frac{1}{2}$
	Sugar	...	...	$\frac{1}{2}$
	Wholemeal Bread	...	...	2
10.0	A.M.—Foofoo (cooked)	...	...	24
	Beef (liver)	...	...	2
	or Fish	...	...	2
	Greens (leaf)	...	...	2
	or Fresh Yeast	..	...	1
	and tomatoes	...	...	1
	Fresh Yeast	...	...	2
	or tomatoes	...	...	2
	Onions	...	...	$\frac{1}{4}$
	Palm Oil	...	...	1
	Cod Liver Oil	...	...	1
	Pepper	...	...	$\frac{3}{80}$
	Salt	...	...	$\frac{1}{4}$
	Kaindah	...	...	a trace
	Fresh Banana, Orange, Mango or			
	Pawpaw	...	...	1
4.0	P.M.—Rice (raw)	...	...	12
	Beef or fish	...	...	2
	Yam or Cocoa yam or sweet potato			4
	Ground Nuts	...	...	2
	or dried beans	...	...	2
	or dried peas	...	...	2
	Tomatoes (fresh or tinned)	...	...	1
	Pepper	...	...	$\frac{3}{80}$
	Salt	...	...	$\frac{1}{4}$
	Kaindah	...	...	a trace
	Rice, millings (a trace cooked in soup)			
	Fresh lime	...	...	a half
<hr/>				
Protein	Fat	Carbohydrate	Calories	
3.26 oz.	3.4 oz.	17.2 oz.	3347	
(increased later to over 3,500).				

I have observed that strict adherence is being made to the new dietary. The quantities are measured with care and accuracy and, when recommended, liberal extra rations are allowed. Judged on accepted standards of vitamin value, there is no doubt but that the diet of the prisoners at Freetown Prison is probably the richest “ vitamin ” diet in the Colony, coupled with an intake of over 3,500 calories, suitable even for men doing heavy work in Temperate Zones. I am convinced that comparatively few of the general populace in Freetown, except the relatively well-to-do classes and the In-patients at Connaught Hospital are as well fed. The prisoners have commented to me that they have never had such good and copious food in their lives; (except possibly in the complaints that the ration of ground nuts is unappreciated and rejected by many men.)

The meals are supplied regularly, warm, and served from clean dishes in clean and tidy surroundings. Unfortunately, despite the fresh meat, greens, spinach, yeast, tomatoes, cod liver oil, fresh fruit, sweet potatoes and ground nuts, Beriberi continued to crop up in the Prison.

I have remarked above that during the earlier part of the work the Prison Hospital was in charge of the Medical Officer and I did not have the opportunity of much experimental work, apart from collecting samples and making observations on diet. Recently, however, since my appointment to be Medical Officer in charge of Freetown Prison, I have had the opportunity of repeating some of the work done at Wilberforce Barracks and of securing new data along experimental lines.

One week before I had taken over the Prison, the Superintendent of Prisons informed me that owing to shortage of supplies, he was obliged to revert to the remaining stock of old rice, containing a high percentage of discoloured grains. I concurred with his apprehension that he would surely have an outbreak of œdema. However, apparently he was left no alternative and could not at the time alter the dietary supplied. Within twelve days the complaints of pain in the chest with gastric troubles began and there were twenty-two cases of the disease noticed in the following fortnight, six of whom had to be admitted urgently to the hospital, where they made a rapid recovery. Six weeks after the issuing of the faulty rice, new grain was obtained and the disease completely disappeared in five days. The œdema subsided and no fresh notifications were made.

Outbreak of Œdema.—The work was directed specially to enquire into the influence of old, “sweated” and fungoid rice and a fortunate opportunity arose for the work.

The Superintendent of Prisons had in the store a large stock of old rice, part of which had been issued to Wilberforce Barracks and to Kissy, and, which, at Freetown Prison, had been held responsible for the present epidemic. Although condemned it was still kept in storage. Up to December 1931, when the epidemic had been lasting from the time the supply of a mixture of new and old musty rice was delivered in 1931, there had been many reports of the sickness. About January 1932 new season’s rice was obtained and this was milled, part-polished and issued to the prisoners. The epidemic subsided and the cases of œdema steadily cleared up.

The stock of new rice became exhausted, however, and the contractor delivered a large quantity of new season’s rice, mixed with the old grain, which from its appearance had probably been in moist storage for a long period. Some of the rice was over one year old and it certainly was not new season’s rice. This was milled and polished in the usual way. The rice contained a fair number of weevil-attacked grains and a large number of black fungoid grains and broken grains. I examined this rice and condemned it, but, for lack of other substances, part of it was fed to the prisoners. Seven days later there were complaints of constipation and pain in the præcordial and epigastric regions and twelve days after the issue of this faulty rice there appeared four new cases of œdema. Three days later there were three other cases, all of whom were admitted to the Prison Hospital for observation. At the time Mr. Biddle assured me that if I wanted œdema cases I would be absolutely sure to get them after the issue of this diseased rice. His prophecy was borne out. On inspecting the men I found eight ambulatory cases distributed indiscriminately among the men (one tailor, one light labour, one mill, two stone breakers, three carriers). All complained of constipation. There was no evidence of nephritis but the general symptoms set out above were observed. They were diagnosed as cases of epidemic dropsy. During this small outbreak, I recommended that the boilings from rice (rice water) should be discarded and not added to soup or given to the prisoners in any form, coupled with the suggestion that the rice be more highly polished to remove the diseased pericarp. The Epidemic has subsided and no new cases have been reported.

The observation that the rice be kept fairly highly polished, leaving about 15 per cent. pericarp, was based on the Laboratory findings of which details are given below. Mr. Biddle had noticed in a previous epidemic that there were fewer cases when the rice was fairly highly polished but no explanation of this point had been suggested.

The Hospital Cases.—When I took over medical charge of the Prison, I was left a case of suspected dry Beriberi, who had been an In-patient in 1929. The man was figured in the Leitch Report (2) as Figure 4, case No. 10122/27. He had typical high-stepping gait, muscular weakness, tachycardia and dyspnoea on exertion and anaesthesia of the pretibial region with no œdema. He had Rombergism, Argyll-Robertson pupils, transient lightning pains at the epigastric and præcordial areas and in the hypogastrium. On receiving the blood results (Kahn XXX Wassermann XXX) I coupled his history of chancre ten years previously, with the diagnosis of locomotor ataxia. Incidentally, I have been treating this case with non-specific protein therapy and he has shown very considerable improvement, especially in his ability to walk without mechanical aid.

The cases of œdema sent to the hospital for observation and treatment were taken along lines similar to those at Wilberforce Barracks Hospital. All the patients admitted displayed the characteristic signs and symptoms, including præcordial pain and nausea, tachycardia, breathlessness on exertion, œdema of the legs with altered cutaneous sensation, deep muscular hyperaesthesia and constipation. The knee jerks were present in all except one. One complained of his failing eyesight, with pain in the eyes, in which the intraorbital pressure was slightly raised. He cleared up after twenty-four days treatment. The blood counts were variable, three being normal and three showing a slight hydraemia (4,100,000).

The blood calcium was definitely lower than normal (10 mg. per 100 cc) and amounted, on the average of four, to 7.6 mg. per 100 cc. In all of the cases, the pulse was increased in tension, without evidence of vascular disease, the blood pressure ranging from 156–168 mm. systolic and 94–102 mm. diastolic. With the rest in bed these values fell to 130–134 mm. systolic and 80–84 mm. diastolic. One week after resumption of their tasks the pressures were still low and normal.

Two of the cases had liq. adrenalin hydrochloride (3 cc. of 1: 1,000) injected experimentally into the œdematous zones of the legs. Localized diminution of the dropsy followed but no generalized improvement of the condition was the result.

In the treatment of these prisoners, two were given calcium lactate and purge and showed improvement with return to labour in nineteen days. One was a case of myocarditis, with mitral stenosis and biliary cirrhosis. He was prescribed digitalin and, although an old case of “Beriberi” reported by Dr. Leitch, he was not considered as

such for the purposes of this work. Two were treated with Mist. Alba (purge) and daily enema. They were discharged after thirteen and fifteen days treatment. Two were given Mist. Alba and an extra ration of meat. They were fit for discharge in twelve days and returned to duty.

The Ambulatory Cases.—Two men had been classified with the ambulatory subjects, who had all been put on the calcium and purge therapy but they did not show any improvement. It was considered that admission to the hospital was the best for them but, at that time, new rice came to hand and was issued to the men. Within five days these two subjects cleared up completely without recourse to admission. No cases terminated fatally in this epidemic.

Whether the lines of treatment follow calcium therapy or purgatives, it is considered that the therapeutic measures adopted against this disease must necessarily be entirely palliative. Not for one moment is it maintained that these measures can ever effectively compete with the simple expedient of altering the dietary to exclude deteriorated rice.

In short I am strongly of the opinion that this is the crux of the entire condition. Granted that the disease, especially in the Prison, can be effectively treated, the advocacy of prevention, is, I consider, the solution of the problem.

TECHNICAL WORK.

Considerable time was devoted in the research to other aspects of the problem, apart from clinical observations. In the main, this other field included post-mortem examinations analyses of urine, blood and faeces, together with a biological survey of the rice. This work had to be done as an addition to the routine duties of my appointment with consequent serious interruptions, after my official duties had been performed.

Post Mortem Findings.

Twenty-four cases were examined after death at Kissy Asylum and one at Connaught Hospital. They were almost all of a stereotyped nature, with œdema of the limbs, pericarditis with effusion and absence of nephritis. In detail, the necropsy in these cases gave the following results.

Externally, œdema, although constantly present in the legs, was elsewhere variable. Some cases had ascites and three had œdema of the face and neck. In some the abdomen was collapsed, in others distended with gas and ascitic fluid. Cutting into the œdematous subcutaneous tissues and muscles showed them to be sodden with serous exudate. The pleural sac contained variable amounts of clear serous fluid, varying in volume from two to twelve ounces. The lungs were adherent to the pleuræ, chiefly behind and some localized adherent patches were present anteriorly and at the mid-lateral right side (near the apex of the middle lobe). The lungs themselves in all cases were œdematous. The pericardium in all the subjects contained clear, free, serous fluid of straw colour. No bile staining, blood cells or blood staining was present in the fluids examined. The volume in the pericardial sac was variable from three to eighteen ounces. The heart showed great hypertrophy in all directions and the right auricle and ventricle were constantly dilated and filled with blood and a small amount of white ante-mortem clot. In all the cases, the valves were competent and revealed no vegetations or other signs of chronic impairment and there were no signs of endocarditis or aortitis. The heart muscle generally was considerably thickened and hypertrophic, without fatty degeneration or infiltration, but showing separation of its muscle fibres by œdema. Except when death had recently occurred, and where necropsy was performed in less than nine hours after death, the abdomen was distended with gas. In the peritoneal cavity of all cases free serous fluid was present varying in amount from a few ounces to two pints. All the cases showed "pseudo-bile" staining of the abdominal fat. On examination this colour change proved to be due, not to haemolytic products, but to palm oil and no bile reaction could be obtained from this tissue. The distension of stomach and intestine was of variable amount and this was probably due to decomposition processes with gas formation. At the duodenum was found constantly areas of engorged tissues, with, in three cases, evidence of ankylostomiasis. The mucosa of the stomach and upper part of the small intestine generally revealed this same type of engorgement and, in three subjects, petechial haemorrhage of the duodenum was added to the hyperaemia. The liver was constantly but slightly enlarged and œdematous and showed evidence of venous congestion. In every autopsy the gall bladder was distended, smooth, glistening and of a dark green colour. There were no signs of adhesions and the surface of the gall bladder did not show the characteristic honeycomb markings of Beriberi avitaminosis as described by Tull (5). The spleen was enlarged on an average to one inch below the costal margin and it was œdematous. The kidneys were of normal size, pale and œdematous, with normal capsule. There was no evidence of nephritis. The suprarenal bodies in five cases were somewhat enlarged and one contained evidence of infarction. No gross changes were observed in the nervous tissues, the bones or the pancreas.

Laboratory Work.—The work done in the Biochemical Laboratory, which was specially equipped for the purpose of this investigation by the Honourable Director of Medical and Sanitary Services, will be considered from its various aspects. It included the chemical assay of rice, biological tests and feeding experiments, together with work on the urine and blood of the patients.

Rice Analysis.

The analyses of the rice for general purposes were estimations of carbohydrate, protein, fat, water, ash, cellulose, phosphorus and amino-soluble nitrogen. They were conducted along the well known standard methods.

Chemical Analysis.—The analysis of the rice husk with special reference to the husk, was not deemed necessary for inclusion in this report because in the milling this article is a waste produce and is not used for any edible purpose. Attention was directed chiefly to the rice grain and the pericarp, with special emphasis on the type of rice which was known to produce the disease, when fed to human beings.

The Colony's new season's rice was employed at first as a basis for standard for comparison of the protein, carbohydrate and fat content and calorie value, but it was suspected that these values would not shed much light on the casual factor of the disease and, in the light of biochemical work done on the decomposition products of the protein layers, I feel sure that the general analysis of the foodstuff, although interesting, is not of paramount importance. However, I have thought fit to submit them.

Standard Rice.—Five samples of new husk rice were obtained locally and found on hand milling to be free from bored grain, weevils, maggots, diseased and discoloured grains. This was taken as standard:—

<i>Standard Rice.</i>						<i>Per cent.</i>
Carbohydrate	...	...	...	...	...	75.87
Cellulose	...	...	...	...	...	0.98
Fat	...	...	...	...	...	1.84
Protein	...	...	...	...	...	8.88
Water	...	...	...	...	...	11.36
Ash	...	...	...	...	...	1.06
P ₂ O ₅	...	...	...	...	...	0.57
Soluble Nitrogen	...	...	...	...	...	0.02

Calorie Value. 364.5 C. per 100 gr. or 1,650 C. per lb. Samples of the equivalent rice taken from the Freetown Prison rice mill, after polishing, were put to similar tests. The pericarp remaining was estimated by the Iodine method, which although rough, gives with experience a good index of the degree of polishing. The residual pericarp in the samples analysed was 40 per cent. In the polishing the major part of the pericarp and the sub-pericarpal layers are removed. The most apparent results are the removal of fat and ash from the unpolished grain.

				Polished Rice 40 per cent. Pericarp.	Polished Rice No Pericarp.
				Per cent.	Per cent.
Carbohydrate	...	...	...	77.38	78.02
Cellulose	...	...	...	0.76	0.64
Fat	...	...	...	0.81	0.52
Protein	...	...	...	8.12	8.05
Water	...	...	...	12.13	12.16
Ash	...	...	...	0.80	0.61
P ₂ O ₅	...	...	...	0.24	0.18
Soluble Nitrogen	...	...	...	0.012	0.010
Calorie value per 100 gr.				358 C	357 C

The rice polishings, that is the "pericarp dust," were also submitted for chemical analysis. Apart from the interest in the research this aspect has, incidentally, a commercial value in view of the possibility of marketing the polishings for cattle feeding and oil cake. It is a waste product of high oil content. Mr. Biddle has been most energetic in the utilization of these waste products and has shown an active interest in this side line with an eye to establishing a market and ultimately to reducing his milling costs.

This pericarp dust contains a fair quantity of sand (about 3 per cent.) with an admixture of husk fibre, which tends to stray over from the hulling machine. The oil content is remarkably high and, although this is essentially a side line, showed indications that the pericarp waste may make a good market price. Its red colour, however, may be against it,

The analysis of pericarp dust obtained from the prison mill, from standard rice freed from sand (3 per cent.) is given below :

				Ordinary	Freed from fibre
				—	—
				Per cent.	Per cent.
Carbohydrate	...	...	...	41·89	48·69
Protein	...	...	...	11·56	11·71
Fat	...	...	...	17·60	17·64
Water	...	...	...	9·96	9·89
Ash	...	...	...	9·41	8·66
Cellulose	...	...	...	9·58	3·41
P ₂ O ₅	...	...	...	—	4·22
Soluble Nitrogen	...	...	...	—	0·06

Beriberi Standards.—Among the conclusions of Vedder and Feliciano (3) (Philippine Islands experiments) are to be found chemical standards for estimating the anti-neuritic (anti-Beriberi) value of a rice in the absence of any direct method of obtaining the exact amount of anti-Beriberi vitamin. These standards include :

- (a) any rice having 1·77 per cent. P₂O₅ plus fat, but not less than 0·4 per cent. P₂O₅
- (b) any rice not having less than 0·5 per cent. P₂O₅ with at least 75 per cent. of the external layers of the grain.

Sierra Leone rice comes well up to these standards with :

- (a) P₂O₅—0·57 per cent. plus fat 1·84 = 2·41 per cent.
- (b) P₂O₅ = 0·57 per cent.

and, according to their accepted theories, there is little risk of development of true Beriberi, when the staple diet consists of this Colony's rice. The rice has a high anti-neuritic value, is well balanced in terms of Protein, Carbohydrate, Fat and has an energy value of sixteen-hundred-and-fifty Calories per pound.

Diseased Rice.—The chemical work, however, was chiefly directed against the "faulty" rice, which, from observations at Freetown Prison and Wilberforce Barracks, was known to be associated with the œdema. When this rice was replaced by new season's rice or was specially treated in cooking, the œdema subsided and no new cases appeared. This rice was supplied as husk rice (paddy) and milled in the usual way before distribution to the various consumers. In this substance attention was particularly directed to the end products, namely, the rice and the pericarp dust, both of which were submitted to chemical analysis in the usual way, the husk, as before, being discarded.

Fungoid Rice Polished 40 per cent. Pericarp.

				Percentage.
Carbohydrate	...	...	...	77·24
Cellulose	...	...	...	0·74
Fat	...	...	...	0·46
Protein	...	...	...	8·46
Water	...	...	...	12·32
Ash	...	...	...	0·78
P ₂ O ₅	...	...	...	0·21
Soluble Nitrogen	...	...	...	0·25

The faulty rice was milled and partly polished (40 per cent. pericarp). The odour was slightly musty. Mycelial hyphæ and spores were seen on the surface of the grains. It was a mixture of white and discoloured grains (yellow, brown, black) up to forty per cent. Evidence of weevil activity was noticed in the bored grain, and weevils themselves (identified as *Calandra oryzae*, *Calandra granaria*, *Tribolium ferrugineum* and *Silvanus advena*) being present together with rice bugs and maggots. Fully thirty-two per cent. of the grain was bored and showed evidence of larvæ. The rice had a relatively high percentage of broken grains, amounting to thirty-seven per cent. On an average, the amount of germ was low, nine per cent. of the grains had all the germ, forty-four per cent. contained a portion and in the remainder the germ had been completely removed either by milling or by parasite activity. The presence of fungoid grain was noted and especially in the discoloured grain could be seen mycelial threads, which were not so common on the sound white grains.

There is at once apparent a deviation from the Standard rice in terms of fat, P₂O₅ and amino-soluble nitrogen; the other constituents being practically unaltered. The combined deviation was thought to be due to parasite activity in the old rice. With this aspect in view, considerable attention was given to the diseased rice products and later to the pharmacological action on animals of extracts of this rice.

Diseased Rice Polishings.—The pericarp dust was subjected to the same type of analysis. This dust is slightly acid in re-action, musty to smell and, when inhaled, causes violent sneezing and coughing. The prisoners employed in the mill are given expectorant cough mixture at the end of each shift to relieve the sensation of oppression it causes, which is worse when the old rice is milled. Some of the men appeared to develop asthmatical attacks when they went on the job at first and in the morning when work commenced. The dust floating about from the mill does not contain free sand in any large volume, even at the outlet of the machines, and it does not cause silicosis; examination of sputa for this condition was entirely negative for the presence of sand and *B. tuberculosis*, although, vegetable fibres are quite commonly embedded in and lying upon large desquamated macrophage cells from the pulmonary epithelium. This pericarp dust was subjected to the same type of analysis before which it was entirely freed from sand and from a large amount of adventitious cellulose fibre derived from the husk.

Pericarp Dust from Fungoid Rice.

				Per cent.
Carbohydrate	...	...	...	48.18
Protein	...	...	...	11.21
Fat	...	...	...	14.74
Cellulose Fibre	...	...	...	3.68
Ash	...	...	...	8.33
Water	...	...	...	13.86
P ₂ O ₅	...	...	...	3.61
Soluble Nitrogen	...	...	...	0.44

Certain aspects are immediately obvious; the increased water content, always generally associated with fungoid activity, together with the diminution of fat and phosphorus and the big increase in the soluble nitrogen into the nature of which obviously it appeared enquiry may be made with profit.

Effect of Washing Rice.—Before proceeding to submit the work done on extracts of the faulty rice and of the pericarp, it is considered advisable at this point to state the effect on the grain of washing. From now onward, unless otherwise stated, it will be understood that the rice mentioned is the deteriorated grain, which was known from experience to be faulty and to produce œdema when eaten and the terms bad and faulty rice will from redundancy be discontinued.

(a) *Rice.*—Apart from removing sand, adventitious insects, weevils and dust, washing with water has a definite effect on the rice itself. The grain is washed in cold (85° F) running water for ten minutes, as the equivalent of the native method in which the washing is done in large pans with several changes of water. Thereafter, the grain is sun-dried and analysed in the usual way. The analyses are tabulated below.

				Before Washing.	After Washing.
				Per cent.	Per cent.
Carbohydrate	...	...	...	77.24	76.97
Cellulose	...	...	...	0.74	0.74
Protein	...	...	...	8.46	8.18
Fat	...	...	...	0.46	0.46
Water	...	...	...	12.32	12.89
Ash	...	...	...	0.78	0.76
P ₂ O ₅	...	...	...	0.21	0.18
Soluble Nitrogen	...	...	...	0.25	0.16

Very little change takes place in the nutritional aspect as expressed by the calorie value. Carbohydrate, fat and protein are more or less the same, but there is a definite, but slight, loss in the phosphorus estimate, amounting to 14.28 per cent. I consider, however, that apart from obvious impurities soluble toxins, expressed in terms of soluble nitrogen are definitely lessened by the washing. Although the soluble nitrogen quota is reduced considerably from 0.25 per cent. to 0.16 per cent., it is apparent that an appreciable amount remains, even after the thirty-six per cent. loss. The phosphorus loss has been considered a loss in terms of vitamin B. McCarrison and Norris (6) proved that any rice originally shown to be Beriberi-preventing may, with removal of a large percentage of P₂O₅ by prolonged washing be altered into a Beriberi-producing grain, but, although this holds for polyneuritis gallinarum, it does not do so for the œdema under consideration, where the vitamin B content is more than adequate. Some other causal agency was held to be at work.

(b) *Pericarp.*—Results of a similar nature were obtained with pericarp dust. The rice polishings were washed in cold running water for ten minutes, squeezed dry, spread out in the sun and dried for two days. As in the case of the rice, no form of artificial heat or of desiccation was employed.

Fungoid Pericarp Dust.

			Before. Washing. Per cent.	Sun-dried. After washing. Per cent.
Carbohydrate	...	.	48.18	48.92
Cellulose	...	...	3.68	3.66
Protein	...	...	11.21	10.98
Fat	...	...	14.74	14.70
Ash	...	...	8.33	7.02
Water	...	...	13.86	14.72
P ₂ O ₅	...	...	3.61	2.48
Soluble Nitrogen	...	...	0.44	0.29

The results are similar to those obtained after treating rice with water. Washing does not affect, to any appreciable degree, the value of protein, earbohydrate or fat, but the main inflnence is shown in the soluble nitrogen and phosphorus content. In the former there is a reduction of 34.09 per cent. and in the phosphorus value washing lowers the content by 31.30 per cent.

Washing with hot water.—The influence of washing was studied in terms of cooking. The rice is brought to boiling point and the rice water decanted and rejeeted. It is equivalent to considering that the rice undergoes part of the normal cooking process when it is washed in boiling water.

Two series of experiments were made :

- (a) in which the rice was thrown into boiling water ;
- (b) in which the rice was put in cold water and heated to boiling point.

In both, after boiling had continued for three minntes, the water was decanted and strained off and the rice dried in the sun for two days. The usnal analyses were made on this final dry rice product.

	(a) Boiling Water. Per cent.	(b) Cold Water. To Boiling. Per cent.	Unboiled and Unwashed. —
Carbohydrate	73.53	72.65	77.24
Cellhlose ...	0.62	0.60	0.74
Protein ...	7.88	6.46	8.46
Fat ...	0.34	0.22	0.46
Water ...	16.93	19.47	12.32
Ash ...	0.70	0.60	0.78
P ₂ O ₅ ...	0.14	0.12	0.21
Soluble Nitrogen	0.02	0.00	0.25

It is obvious again that, with special reference to all the proximate principles the energy value of the rice is not seriously impaired by this treatment, when it has been boiled and the rice water rejected. This value is, undoubtedly, not so greatly affected by throwing the rice into boiling water for a few minntes, as when the rice is brought slowly to boiling point, because then the degree of imbibition of water is less with correspondingly higher value of protein, carbohydrate and fat.

By either method, although the loss is fairly considerable (33.3 per cent. and 42 per cent.), the phosphorus element is not by any means all removed by short immersion in boiling water. Soluble nitrogen, however, shows results which are to be expected from the method of its estimation. The reduction amounts to 92 per cent. of the total original soluble nitrogen method (a) and to complete absence in (b) when the rice water is brought to boiling point “from the cold.”

Results of a correspondingly similar nature were obtained by extracting the periearp dust employing these same methods ; that is, a large reduction in the P₂ O₅ content and in the soluble nitrogen. However, as this is a waste product, it is not deemed essential to submit the results.

For the purpose of this research the intimate analyses of the rice washings are not given here, as this aspect is more or less of aeademie interest.

Culture of Grains.—Inspection of the rice revealed, as was mentioned above, the presence of discoloured grains, mixed with normal white rice. These grains were divided into two groups, yellow and black, for culture experiments and special analysis. The discoloured grains were, in all eases, found to be dead ; microscopically, erosion of the starch was in progress and the grains were eontaminated with myeelial septate filaments. Samples of white, yellow and black grain were surfaee sterilised and put in a warm moist chamber for thirty-two days. All the rice samples increased in water content. The black grain became sodden and soft. Its soluble nitrogen content increased from 0.59 per cent. to 0.85 per cent., with very slight loss in the

$P_2 O_5$ due to imbibition of water by the grain. The yellow grain turned to a dark brown colour, almost black, absorbed water but it did not become sodden and soft like the black variety. The soluble nitrogen increased also in this case from 0.28 per cent. to 0.39 per cent., again with slight alteration in $P_2 O_5$. The white grain, like the other two groups, developed a heavy growth of mould, but the colour change was not so marked. Some of the grain (3 per cent.) became brown and some (35 per cent.) was stained yellow, but the rest was more or less unaltered in colour, being, if anything, of a greyish tint. The soluble nitrogen increased in this sample, as in the others, from 0.03 per cent. to 0.09 per cent. It was assumed that these conditions, although not by any means similar to normal storage, would reproduce rapidly in the grain that which occurs in storage in the country over a long period of time. Under conditions of moist warmth, with the possibility of increased temperature by fermentative processes in a large mass of grain, heat is generated and cannot escape readily from the decomposing mass. In this way, with heat and humidity, the growth of fungi and of other organisms is exceptionally rapid, with the net outcome that decomposition proceeds apace.

Preliminary Work with Extracts.

In the initial part of the enquiry, chemical work was held up on account of the complete absence of suitable apparatus and re-agents, with the result that the early work was devoted, chiefly, to clinical and statistical observation. Fortunately, the Honourable Director of Medical and Sanitary Services was able to secure the whole equipment of the Agricultural Chemist's Laboratory, that post having been abolished. With this material a new biochemical laboratory was set up at the Connaught Hospital. Preliminary work was, however, undertaken to determine, if possible, the lines which might be profitably followed. The outcome of this preliminary investigation was the conception that the disease, œdema, was not due to lack of vitamins per se, but to soluble decomposition products in the rice, akin to the "claviceps" disease of rye, an idea that necessitated submitting extracts of the grain to biological tests.

The first extracts made of the rice were evaporated in vacuo to small bulk without attention to percentage concentration. They were sterilised, without heating, and injected subcutaneously into normal subjects and to œdematous cases. Localised œdema resulted, associated with a marked re-action. Similar extracts were scratched into the skin and there was produced a flat raised wheal with white centre due to vasoconstriction together with a surrounding zone of slight erythema, such as is obtained when histamine and allied substances are injected intradermally. This effect is too well known to require at the moment detailed description. Subsequently, from the rice polishings, both unfermented and fermented, raw and cooked, extracts were made and tested chemically and biologically.

Chemical Assay of Extracts.—The re-actions were suggestive of the histamine grouping of substances, obviously, therefore, the chemical tests, in view of these re-actions, were directed to a study of the iminazole derivatives in the extracts, and one of the most delicate chemical tests for this group was employed.

The rose-pink colour struck by alkaline sodium diazobenzene-p-sulphonate is given by dilutions of histamine even to 1:10,000 but this re-action is not, however, absolutely characteristic of histamine alone. It may be given by any iminazole derivative containing a free amino group, together with a replaceable group in one of the two, four or five positions, with the exception that no colour is given should a nitro-carboxyalkyl or carboxyanilide group occupy the four or five position and it may be obtained in the presence of bases in the arginine, purine and tyrosin groups. A negative result is taken to show that histamine is absent, or, if present, only in infinitesimal quantities, but a positive re-action shows that either it or the allied bases may be present. The most reliable test is obtained by biological assay, employing intradermal tests and the effect of the substance on the isolated uterus, together with the persistence of these effects after alkali hydrolysis.

Extracts of Rice.—The extracting media employed were all found to give negative results when used as controls, either chemically or biologically and the same weight (100 grm.) of material was used from which the extracts were made, together with constant volumes of the various extracting agents.

All the extracts made from new rice gave entirely negative re-actions to the histamine intradermal tests. Similar results were obtained from rice that had been—

- (a) put in cold water and heated to boiling ;
- (b) immersed for a few minutes in boiling water.

Dry faulty rice, however, gave positive results in most cases. In the presence of increased proportions of discoloured grain, the re-actions were increased in intensity. The polishings from the faulty rice yielded re-actions of a very definite type. It was, however, when employing the mouldy grain and fermented pericarp dust that the strongest effects were obtained, especially from rice with a high percentage of black moulded grain showing putrefactive changes.

There was obtained a definite increase in these histamine bodies when the discoloured grains were kept for a period in the warm moist chamber. The intensity of the re-action was greatest with black grain, less with yellow and from the white rice no re-action could be obtained.

Feeding Experiments.—Feeding experiments were conducted at Comaught Hospital and at Wilberforce, employing fowls and guinea pigs.

In the earlier observations, four fowls were used. Two were fed on washed (method b) grain and two had unwashed rice. These experimental animals were allowed to roam about as they pleased and to eat such green material as they thought fit. After five weeks, one of the latter died and was found to have congested liver and pericarditis with effusion. The lungs were slightly engorged. Its partner on the unwashed diet was killed one week later and found to have slight pericardial effusion with engorged crop and hyperæmia of the stomach and upper intestine. At the same time the other pair on the washed rice were killed and found to be perfectly healthy.

Guinea pigs were useless for feeding with dry material because they refused flatly to eat the rice. This was, to a large extent, overcome by making an extract of the grain, mixing this into bread and feeding the wet product to the animals which ate the mass avidly. The animals thrived on the extract from standard rice and from musty rice which had been washed. When killed the carcasses were those of healthy animals.

Extracts from dry, faulty rice and pericarp did not kill the animals immediately but they went off their food after fifteen days and refused to take the quantity they consumed at first. One animal died after twenty-one days on this food (bread soaked in aqueous extract of rice). It was found to have slight œdema of the lungs and acute gastro-enteritis. Three guinea pigs were fed with greens, grass (their usual food) and with the addition of bread soaked in an extract from the fermented discoloured rice grains. Ten days later the first animal died; its two companions succumbed the next day. The post-mortem examinations again showed œdema of the lungs with gastro-enteritis, engorged intestine and hæmorrhages at the upper area of the duodenum. These animals apparently suffered intense pain, as they were exceptionally tender to touch, listless and breathless. They became very weak and scarcely had the energy to run away when approached.

Inoculation.—To ensure absence of bacteria and yeast spores, the extracts were freshly made and sterilised, without heat, which might have altered the toxins. Guinea pigs were used into whose flanks the extracts were given subcutaneously only.

The extracts of new season's rice caused no sickness in the experimental animals. No ulcers or abscesses were produced at the site of inoculation. The animals were injected daily for eight days and found to be normal when killed.

Inoculation of sterile extracts of the old fungoid rice made the animals highly excitable five minutes after injection but in half-an-hour this passed off. Three days after inoculation commenced the animals became listless and refused to take their food. Of the three animals used two died after five days of injection treatment (an injection of one cc. extract being given daily) and the remaining one died in seven days. All showed similar pathological changes. Around the sites of injections were zones of hyperæmia but no pus or septic condition was observed. The heart was congested, the lungs engorged and distended with blood, and there were punctate hæmorrhages in the small intestine.

An extract made of pericarp dust that had been kept under moist conditions was sterilised and inoculated into a guinea pig. This animal died one-half-hour after injection. The necropsy revealed hyperæmia around the site of inoculation. The lungs were fully distended but not œdematous. The right heart was dilated, the intestine gorged and the stomach contracted in spasm. Entirely negative results were obtained following the injection of sterile extracts of washed rice.

The contraction of the isolated involuntary muscle was studied in a roughly constructed piece of apparatus, using preparations of the uterus and intestinal muscle of the guinea pig. The preparation passed into powerful contraction on exposure to an extract of the faulty pericarp dust. This contraction was not, in any way, counteracted by the addition of atropine.

Urine Analysis from Patients.—With the exception of two suspected cases of œdema in whose urine was found albumin with granular casts, no obvious pathological changes of the usual types were found.

The urine in general was pale straw coloured, very slightly acid on re-action, having a specific gravity of 1022. When passed, it was free from sediment and "mucous" clouding but, on standing till cold, "earthy" phosphates were deposited. The usual ammoniacal phosphates appeared on allowing it to stand for twenty-four hours. In almost all the cases the output of an excessive amount of the "earthy" phosphates was commented upon and considered to be not clinically normal. The buffer action of phosphate in the blood is considerably higher than that of sodium bicarbonate, from which observation it is suggested that the increased urinary

phosphate value represents the end product of a successful attempt by the alkali reserve to neutralize the acidity produced in the toxæmia. The absence of albumin and the presence of these phosphates tend to show that the renal mechanism in this disease is not grossly abnormal; an observation confirmed at the post-mortem findings.

Only in the severe cases was the indoxyl re-action obtained to a marked degree but almost all the specimens of urine from the patients gave a positive test indicative of indole b. acetic acid. Albumin, blood, sugar, diacetic acid, acetone bodies and bile products were not observed to be present in pathological amounts in these urines.

Fæces Analysis.—Apart from the presence of a trace of occult blood in seven cases, the analysis of the fæces did not shed light on the problem.

Blood Calcium.—The recognized methods of analysing the amount of Calcium in the blood were employed in a study of some of the prison cases. On an average, the results showed calcium deficiency (7.6 mg. per 100cc) which is a definite deviation from the accepted normal value of 10 mg. per 100cc. The work along these lines continues.

In the main, I have submitted the results of the observations and findings from the biological aspect of the research, without, in any way, attempting to give every detail of the technique employed, which followed generally the standard methods in use. In short, it was considered superfluous to encumber this report by needless reference to well-known laboratory technique.

DISCUSSION OF THE PROBLEM.

To discuss œdema is to invite contumely with the result that many who have chosen this subject for wordy consideration appear to have sought shelter in the experience of others, rather than to “rush where angels fear to tread.” It was Bright, I think, who advised that discussion of such a subject is fraught with hectic controversy and ought to be approached in a chastened tone.

Oedema is the condition wherein accumulation of clear watery fluid occurs in the body cavities and in the tissue spaces, various names being applied to the condition, according to the site of the dropsy. However abnormal may be the final results of this swelling, it has often been considered, not in the light of a qualitative change, but rather as a quantitative departure from the normal state, of which the main factors concerned are the hydrostatic pressure of the body fluids and the osmotic pressure of the tissues, balanced by the osmotic pressure of the blood crystalloids and plasma colloids, together with the permeability of the capillary walls. In this light, therefore, we should expect to have the essential phenomena associated with œdema grouped as follows:—

- (a) Increased permeability of the vessels following the effect on the vascular walls of disease, vasomotor paralysis, toxins, prolonged dilatation.
- (b) Increased capillary pressure as a result of venous obstruction by tumour and thrombosis.
- (c) Obstruction of the lymphatic flow, by the same causes as in (b).
- (d) Increased blood pressure.
- (e) Decrease in osmotic pressure of blood, especially of the colloid system of the plasma.
- (f) Increased osmotic pressure in the tissues.
- (g) Increase in the imbibition capacity of the tissue protein.

Although in some cases one of these factors alone may be present to produce the œdema, it is more customary to find two or more acting in unison, in which case there is the difficulty of allocating to the principle role the causative agent. An instance of this may be cited in angioneurotic œdema. It is commonly found in nervous subjects or in emotional people. It has been held to be due to a vasomotor paralysis associated with a circulating toxin. Quincke (7) observed that section of the vasomotor nerves did not alter the dropsy and concluded that the main factor must be in the nature of a circulating toxin.

Causes of Oedema.—It has been found convenient to consider œdema under six headings to include the following:—

1. Cardiac
2. Renal
3. Inflammatory
4. Obstructive (venous and lymphatic)
5. Toxic associated with Milroy's hereditary œdema and the angioneurotic group
6. Nutritional :
 - Beriberi—Epidemic dropsy
 - War œdema
 - Anæmia and debilitating states.

The œdema with which we are dealing is not considered to be associated with those found in cardiac, nephritic, obstructive or inflammatory diseases, and, on this account, it is not deemed necessary to enter into a detailed discussion of those conditions. With similar scant treatment has been regaled the œdema of anæmia and cachexia and Milroy's hereditary œdema but in view of the results of the investigation it is proposed to discuss further toxic and nutritional dropsies.

Toxic Oedema.—The allergic re-actions following the ingestion of certain foodstuffs by peculiarly sensitive individuals are fairly well known. These may appear as asthmatic attacks, hay fever, skin rashes, either with small localised wheals or with the extensive urticaria which is now considered to be identical with an angioneurotic œdema. Lewis (8) maintains that the toxic substance is either histamine or an allied iminazol ring derivative. The wheal is the outcome of increased permeability of the dilated capillaries and may be simulated by the intradermal or subcutaneous injection of histamine. The extensive œdema found in the angioneurotic type is held to be the result of circulating toxins of an allied type derived from some articles of diet acting on the vessel walls and not to be due entirely to any vasomotor paralysis because section of these vasomotor nerves has no marked influence on the œdema or on its production. The net result is increased permeability of the tissues. Substances which reduce this permeability, by antagonizing the effect of histamine bodies, naturally should be expected to effect a curative influence. Epinephrine is of such a nature. The injection of liq. adrenalin hydrochloride reduces the dropsy by its vaso-constricting influence. As has been shown above, the œdema constituting the major theme of this enquiry was definitely, although chiefly locally, diminished by the injection of adrenalin. Ionic calcium is also successful in this effect, although the evidence that it has any direct effect of diminishing the permeability of animal membranes is still conflicting. However, the results of the calcium therapy in this outbreak of œdema were too encouraging to permit of its disuse on theoretical grounds alone.

Nutritional Oedema.—War œdema was first seen amongst Turkish prisoners of war and in the famine stricken zones of Europe. In Austria, Germany and in some parts of Russia, many cases of dropsy were reported, without any concomitant signs of nephritis or cardiac disease (Epstein 9). The condition was associated with anæmia, marasmus and gastro-intestinal disturbance; albuminuria being a variable sign. The disease is not a simple matter of deficiency of the accessory food substances, but appears to be the result of a diminution of protein-intake in a diet rich in carbohydrates made palatable by copious additions of water and salt, which, in the starving state is readily retained in the tissues. In the same category may be included the dropsy of marasmus and of Addison's anæmia.

Beriberi.—Beriberi and allied conditions are diseases particularly associated with people whose staple diet is rice and in this Colony it must necessarily assume exceptional importance. In view, also, of the development of rice growing in this Colony, the disease occupies a position of commercial importance as well. Unless great attention, therefore, is paid to these conditions a young and promising export trade may easily perish, almost in infancy.

As is well known, true Beriberi-avitaminosis is held to present two aspects:

- (1) Wet Beriberi in which there are œdema and serous effusion into the general body spaces.
- (2) A dry paraplegic type with characteristic peripheral neuritis and muscular paralysis.

Although it has been reported on widely separated zones, having been observed in asylums in England and America and among the British troops in Mesopotamia (1915) it has, roughly, three great endemic areas: Japan, Brazil and Dutch East Indies, with isolated foci in India, Malay, Philippines and on the East and West Coasts of Africa. Stitt (10) informs us that its history is ancient. It was referred to in Chinese writings as remote as 2697 B.C. It occurred in the Roman Army's invasion of Arabia 24 B.C. The neuritic type was described by Bontius (1642). Rogers (1808) and Marshall (1812) differentiated the wet and dry types.

Theories of the Etiology of Beriberi.—Quite a number of theories have been put forward to explain its etiology and many of these have, apparently, been found wanting. Takaki (1884) (11) suggested nitrogen deficiency as the cause of the condition in the Japanese Navy and it was recorded that improvement resulted when an increased allowance of protein was given, especially in the form of beans. Many workers, however, refer the eradication of the disease among these sailors to the improved sanitary conditions of the men.

Manson (12) put forward a theory of toxæmia by micro-organisms associated with conditions of overcrowding, filth and faulty ventilation, whereby the germs gave off an emanation or toxin which acted to the detriment of the patient, who himself was not infected actively by the germs.

In Wright's (13) view there is a definite bacillary invasion of the mucosa of the duodenum from which toxins allied to those of *B. diphtheriæ* are passed into the patient. Although other workers Higuchi (14), Montes (15) have submitted various organisms with this idea in view, so far no germ has been isolated which is known definitely to cause the disease.

Hirsch (1881) (16) was among the earliest to suggest that the cause of the disease was some specifically noxious thing in the food and that this was represented by a poisonous property of decomposed rice.

Studying the disease in Malay, Braddon (1901) (17) furthered, most considerably, this idea. He maintained that the cause of the disorder is not rice, *qua* rice or as an article of diet but diseased rice. Braddon (18) propounded the view "that the condition was associated with rice with which poison derived from decay, due, perhaps, to some fungus or mould, or germ or spore, originally, perhaps, growing in the husk, has become mixed during the process of milling or upon which such fungus may have grown and such poison have been produced after decortication." *Inter alia* he suggested perboiling of rice before husking, with the conjecture that this process destroys the hypothetical organism. It may also, I suggest, have the same effect as washing before cooking of removing such soluble toxins as have already been produced.

The development of the toxin was thought to occur in rice stored in a damp place but Vedder (19) (20) disputes this, by stating he found no evidence of loss of anti-Beriberic properties in rice so stored after one year.

Wydooghe's (21) observations in East Africa are most interesting. Although he favours the theory of infection borne by an insect vector, he passes the remark that the epidemics are worse during the wet seasons, when moulds have every opportunity of growth on rice in storage.

The position in Brazil is remarkable, where the medical men state that, although a diet of polished rice may produce a disease with symptoms of Beriberi, they believe that the disease they call by this name is an infectious disease. They advise, states Conto (22), that such patients who complain of the ailment should go to the South, where, although the same rice is eaten, Beriberi is unknown. The relative humidity of the North and South of Brazil should, I think, be borne in mind, together with the concomitant facility for rapid fungoid activity.

Several references have been given concerning the presence of proteolytic organisms in rice used by people suffering from Beriberi and Epidemic Dropsy, particularly in the researches of Bose (23), Mendes (15), Bernard and Guillerm (24), and Higuchi (14). Drs. Leitch and Watson (2), however, cannot credit that these proteolytic organisms can be the casual agent of epidemic dropsy, which, they state, is a comparatively rare disease.

Fraser and Stanton's (25) work on the subject is monumental. They demonstrated that polyneuritis gallinarum and beriberi, especially of the dry type are undoubtedly due to deficiency of or absence of vitamin B. Their work has received considerable support by the researches of Shiga (26) and McCarrison (27), and their conclusions are now accepted almost universally.

Recent work has shown that vitamin B, whose absence is the cause of Beriberi avitaminosis is a pyrimidine substance, trimethyluracil, a derivative of nucleic acid, which is exceptionally prone to putrefactive changes, with the result that diminution of or destruction of its value as an accessory food substance is produced. The absence of vitamin B does not, therefore, necessarily, indicate that the causal agent of diseases simulating Beriberi is deficiency of the vitamin *per se*. With its destruction must be considered any concomitant putrefactive products of these higher heterocyclic and amino-acid compounds so that these diseases held to be due to absence of or diminution of any accessory food material *per se*, may equally well be due to the effects of autointoxication following absorption of the decomposition products, resulting from the activity of bacteria and fungi. It is this latter conception of the etiology that is maintained to be proved in the present epidemic especially in view of the fact that ample supplies of vitamin B in other forms of food had no effect in averting the disease.

Epidemic or Famine Dropsy.—Apart, however, from all the work on Beriberi and polyneuritis gallinarum, there is that remarkable disease Epidemic or Famine Dropsy, which has signs and symptoms peculiarly akin to Beriberi of the wet type.

History.—McLeod (28) first described the condition in Calcutta (1877) whither, in famine years till 1926, it has returned repeatedly. Large masses of rice-eating people, both natives and poor Europeans, were effected by this disease which was reported to occur in the wet seasons and to abate in the hot dry seasons.

Acton (29) and others, making observations on the Calcutta Epidemic (1926), state that, although it affected the rich as well as the poor, the condition was worse among the poor families living in damp, unhealthy houses. It was considered that there was no deficiency of vitamin "B" but that the cause of the disease was bacterial decomposition of the rice, which, the main diet of the people, had been damaged by flooding. Other workers regard the condition to be one due to deficiency of calcium salts.

Signs and Symptoms.—Gupta (30) gives the major signs and symptoms of this disease as follows :—

Fever, usually 99–101°F, rarely above 102°F, œdema, gastro-intestinal disturbances with diarrhœa, cardiac dilatation, tendency to hæmorrhages, enlargement of the liver, pulmonary congestion and a variable peripheral neuritis.

Neil Campbell (31), I.M.S. in the *Indian Medical Gazette* described as occurring in Dacca Lunatic Asylum (1908) an epidemic of this disease, which bears remarkable similarity to recent conditions at Freetown Prison. From a population of two hundred and seventy, one hundred and forty-seven cases were affected within a period of five days, although all had been having copious, varied and wholesome diet. A consignment of faulty rice was held to be responsible for this "explosive outbreak."

With conspicuous clarity, Megaw (32), I.M.S. described the scope of the disease designated Epidemic Dropsy. His remarks are summarised in the following outline:—

"It affects rice eaters who have been partaking of parboiled rice, which has been stored for months in a hot moist place. Unhusked rice or paddy stored under similar conditions causes the disease. All the affected persons have eaten rice from the same store, although households may be widely separated from each other. Many of the outbreaks are "explosive"—the patients' symptoms occurring within a few days of each other, even when they live far apart."

The disease does not run a course like an ordinary fever but stops, excepting in the very advanced cases, when the faulty rice is removed from the diet. The seasonal distribution in India is remarkably uniform, commencing just after the beginning of the rains and ending after the rains have ceased. When the new season's crop is used the disease disappears. Outbreaks occur always in people who have eaten rice which had been stored under hot moist conditions.

There is no evidence that the diets of the patients have been defective in any obvious respects compared with diets of the unaffected people in the same locality. Some patients, in fact, are better off as regards vitamin foods than their neighbours. The occurrence of the disease is not associated in any way with an obvious change of diet. The food may seem the same but this does not obviate the possibility of a food poison (c.f. death botulism) although certain changes may be detected. When several people in the same house or locality are affected in rapid succession, there is no need to presume infection, if the same morbid agency, faulty food, is common to all.

In no case has infection by contagion been recorded. Most of the outbreaks are best explained as being due to a toxic agent, which is present in the rice before it is eaten. No immunity is conferred but, on the contrary, one attack predisposes to further attacks. The "incubation" period is variable, two to ten days elapsing before the onset of the symptoms. Convalescence, except in severe cases, is rapid, when the case is properly handled from the onset of the condition.

With all these features, the most reasonable explanation is that, under certain conditions of storage, rice becomes toxic. The poison by ingestion causes gastro-intestinal irritation and, on absorption, damage to the peripheral nerves and involuntary muscular system.

I am convinced that such a remarkable parallel exists between the conditions pertaining at Freetown Prison, Wilberforce Barracks and Kissy Asylum and the outbreaks of Epidemic Oedema in India, as to make one hesitant of accepting, without considerable proof to the contrary, a diagnosis of avitaminosis or Beriberi in the disease which is the subject of the present investigation.

HISTAMINE.

Histamine.—The majority of proteins contain the substance Histidine, which is an amino-acid derivative, containing the heterocyclic iminazole ring. Histidine is *B. iminazole-a-amino-propionic acid*, which, by the process of decarboxylation is converted into ergamine or histamine (*B. iminazole-ethylamine*) a substance commonly found as a product of putrefaction. It is obtained as a constituent of ergot and of putrified flesh and it occurs in some quantity in the intestinal contents.

Pharmacology of Histamine Group.—The action of Histamine is akin to a number of the derivatives of the split protein molecule, in which, often, a very slight alteration is sufficient to convert a non-toxic substance into a poison with the characteristic actions of the Histamine group.

Secondary shock following severe wounding and crushing has effects so closely allied to those of Histamine inoculation as it has been maintained that this type of shock is due to the production of Histamine in the damaged tissues. Anaphylactic shock is probably of a similar nature.

The results of exhibition of members of this group in the human subject vary with the dose and with the tissue re-actions of the individual. At the site of injection a slightly raised white wheal is produced, having a circumscribed zone of intense erythema. The wheal is tender to pressure and later the area may be very irritable. Dyspnoea often occurs with the expectoration of sticky mucus. The pulse is rapid and the blood pressure may fall, although this varies with the individual. Sickness, with vomiting, may occur and the stomach undergoes powerful contractions, sometimes with the production of small hæmorrhages. The circulation becomes sluggish and all the symptoms of severe shock with collapse follow, especially if any physical efforts are made.

Effect on Animals.—The effects of this group of substances, tested experimentally on animals, have been found to vary with the species and, also, with the feeding habits of the animal, whether carnivorous or herbivorous.

Circulation.—In the herbivora the arterioles are constricted and the blood pressure, consequently, is increased, whereas any initial vaso-constriction is absent in the carnivora, in which the capillaries become widely dilated and the blood pressure rapidly falls. This vaso-constriction is due to a direct action on the muscles of the arterioles, with the result that products of metabolic activity cause loss of capillary tone and dilatation, so that the animal finally bleeds into its own capillaries. The venous return is, consequently, insufficient to distend the heart and collapse supervenes.

Following the accumulation of blood in the capillaries and the consequent stasis of metabolites in the tissues, with increasing osmotic pressure, the escape of plasma from the capillaries is facilitated and œdema is produced. In the excised heart preparation the outflow is usually augmented and accelerated.

Stomach and Intestines.—According to Cushny (33), these organs contract more powerfully and may pass into spasm. Small hæmorrhages may be produced as a result of this condition. Most sensitive of all is the uterus, in which the contractions are sudden, prolonged and powerful.

It has been proved that, in small quantities, amine bodies are known to cause intestinal stasis, with consequent absorption of poisonous nitrogenous waste products. These act on the vaso-motor system, producing constriction of the arterioles and relaxation of the capillaries; the opportunity results then of exudation into the tissues of plasma, together with a partial stagnation of the movement of the tissue fluid. On this theory of toxic absorption was based the treatment. Purging and enemata keep the intestine in an active state and prevent or reduce the rate of absorption.

Calcium improves the tone of the vessel walls and aids in the reduction of the œdema. In this condition the blood calcium was found definitely to be low, so that the calcium lactate is of benefit, especially if associated with sodium citrate in the presence of which it is more easily assimilated.

Histamine does not appear in the urine but is destroyed in the tissues by deamination and oxidation.

Toxicity to Herbivora.—Histamine is exceptionally toxic to herbivorous animals but not to such a great extent to carnivora. It must be conceded that the majority of the subjects in this Colony ought to be considered vegetarian (or cereal eating) people and a change to a diet richer in meat with consequent higher protein value may help to reduce the incidence of the disease. The success of this factor was demonstrated by Mr. Biddle (1919) when, during a short epidemic, increased meat rations were issued with considerable benefit to the patients and diminution in the number of fresh cases.

Comparison with Epinephrine.—In certain points, the re-actions of the histamine group resemble those of epinephrine, whose effect is chiefly, sympatho-mimetic on account of its powerful action on the post-ganglionic fibres of the sympathetic nerves. A number of substances resemble epinephrine, both chemically and pharmacologically. Many are synthetic products but a number occur in the decomposition of the protein molecule in the presence of putrefactive agents. Perhaps tyramine is the best known; like histamine, it occurs in ergot preparations. Tyramine is p.hydroxy-phenylethylamine and is a decomposition product of tyrosin, one of the commonest amino-acids.

Relation to Ergotism.—Taken at face value, Epidemic Dropsy does not appear to have any obvious relation to the chronic poisoning of ergotism, or to dry gangrene with peripheral neuritis. Both, however, appear to be vaso-motor disturbances of varying degree (extreme on one hand and less severe on the other) and they appear, also, to be due to products of decomposition. Tyramine and histamine are commonly associated with this condition and are found in ergot. They are held to be produced by the same type of chemical change, namely, decarboxylation, allied with decomposition.

Melanin.—It may be interesting to note another line of decomposition of tyrosin. Instead of by decarboxylation to phenylethylamine or tyramine, tyrosin is oxidised in the presence of the enzyme tyrosinase to the black pigment melanin via a red coloured substance, having the nature of a phenylalanine, which, in turn, can give rise to phenylethylamine. Fungi and the larvæ of meal worms are rich in the enzyme tyrosinase, so that further comment on the presence of these organisms may be considered superfluous, when regard is taken of the discolouration process in the rice grains. In the experiments on fermenting rice, colour changes are produced the red brown pericarp becoming black and it will be recalled that from the black grain the most toxic extracts were derived. It is thus possible to base the degree of toxicity of the fungoid rice on the proportion of these black and discoloured grains, as an index of the state of decomposition and of the danger following its consumption.

Moist storage.—The disease most commonly puts in an appearance when old and new rice crops have been mixed, and Mr. Biddle has noticed that the disease breaks out in the year succeeding that of a bumper crop, with large stocks of old rice left in the dealer's hands after the new crop comes in. The new crop contains a much greater proportion of moisture. In these circumstances, mixing appears to favour decomposition. Fungi and the dormant spores of fungi have improved facilities for growth on account of the increased moisture content of the mixed mass and of the heat engendered, as in some cases of so called spontaneous combustion by the fermentative changes in a moist heap. Storage during a rainy season appears to be ideal for such organismal activity because of the heat and the high relative humidity. These, it is maintained, are the attributes that make the problem serious in this Colony. It is held that the rice becomes highly toxic if it is a mixture of old and new crops and is stored in conditions that encourage destructive attacks by fungoid and other organisms. If mixing of crops is permitted there is absolutely no guarantee but that these outbreaks of fatal epidemic dropsy will be repeated and I make bold to assert that this is one of the essential factors determining the control of the disease.

In addition to the effect of mixing old and new crops, there is accumulating evidence that similar and rapid destruction occurs when new season's crop is kept in wet storage, or stored in an imperfectly dried condition.

It has been observed, as in other tropical and sub-tropical countries, that the disease appears when grain is eaten after prolonged storage under moist warm conditions. Famine conditions, with shortage of new crops, may readily be simulated when a sword of Damocles is held over a community forced to accept and to use old rice that has been kept under faulty conditions. Again, although no such obvious state may exist, it is simple to produce an artificial famine by market manipulations in a commodity which, in the tropics, is liable to rapid destruction on account of the entire absence of supervision, or proper control of store-houses and granaries.

That there are changes in the intimate chemical structure of the rice is seen from the change in soluble nitrogen and phosphorus content. These are associated with putrefactive changes. With an increasing value in the soluble nitrogen content, there is found evidence of increasing destructive changes. That the destructive change results in the production of soluble toxic substances has, I think, been established clinically, biochemically and physiologically, when extracts of this rice are made and utilised either for animal inoculation or for chemical study. Apart from the observations made on human subjects and in the field of clinical medicine, there are the concomitant results of the biological experimentation of which recapitulation is unnecessary. This toxic element is soluble in water, a point demonstrated by the beneficial effects of washing the rice and rejecting the rice water resulting in the almost entire removal of a soluble toxin whose nature is, essentially, that of the histamine-tyramine groups. It has been shown that the soluble nitrogen factor in relation to total nitrogen may be considered a reasonably good index of the toxicity of the foodstuff.

When new rice is given to patients suffering from the œdema under review, the disease rapidly clears. In a way this may be the outcome of several factors. There is the resistant state of the living rice germ to disease, associated with the nondestruction of the protein aleurone layer and there is the factor of time, as new season's rice has not been subjected to prolonged bacterial and fungoid activity. Consequently, one expects even from this last aspect little, if any, putrefactive changes.

When considered purely as a disease due to the lack of vitamin B, it is difficult to understand why, with the superabundant diet issued at the Freetown Prison, Beriberi should continue to be present, and also, if its nature is essentially one of "avitaminosis," why the disease should be of so protracted a type, when additional accessory food substances almost to excess are exhibited. On the other hand, the aspect that this disease of œdema is due to toxic absorption, finds support on a number of points.

Conclusion.

I am convinced, therefore, that œdema at the Freetown Prison, Wilberforce Barracks, and Kissy Asylum is not that of Beriberi (avitaminosis) but that it is akin to epidemic dropsy. It is not associated with any lack of or diminution of accessory food substances, as vitamin "B," which has been supplied in copious amounts to the inmates of these institutions, nor is it allied with protein starvation. The disease is essentially one of auto-intoxication, due to absorption of highly poisonous nitrogenous putrefactive products, engendered in old rice by the activity of organisms acting in hot and moist conditions and producing bodies of a nature allied to the histamine-tyramine groups. The toxic substances are water soluble, especially in hot water, and they are capable of withstanding boiling water, without considerable alteration of their poisonous principles. This last observation is important, as recommendations have been made in former epidemics that the rice water should be saved and added to the soup.

The disease-producing grain has a musty odour and, generally with discolouration, displays the presence of decomposition and of fungoid activity. Consumption of such foodstuff is fraught with great danger, resulting, *inter alia*, in the rapid onset of œdema of an extremely fatal nature.

Rice forms the staple food of the Colony and owing to a rapid extension of swamp-rice farming during the past three years an export trade in it is anticipated. Oedema, therefore, becomes a matter of serious concern, especially, where it is known that apart from its incapacitating effects this condition is attended by a very high mortality among consumers of rice which has been permitted to become decomposed.

To Mr. G. E. Biddle, the Superintendent of Prisons, for his helpful and considered comments, based on a lifelong experience of the disease, I offer my thanks. My most sincere gratitude for his encouraging sympathy is extended to Dr. J. C. S. McDonall, without whose energetic assistance in providing the laboratory this work would have been impossible.

CENSUS OF WILBERFORCE BARRACKS COMPOUND.

Hut.	Room.	Defin.	Occupants.	Animals.	Beds.	Oedema.
1	1-2	O	M	D P	U. S.	
	3	O	FF	H5	1	
	4	K				
	5	U				
	6-7-8	O			1	
2	1	O	M F	CF	D	1 1
	2	S U		P		
	3	O	M F		1	1
	4	S O		S	1	
	5	S U				
3	6	O	M F			2
	7	O	M F		1	1
	8	S		P		
	1	O	M	D	1	1
	2	O	M F		2	
4	3	O	M F	D	1	1
	4	O	M F		1	1
	5	O				1
	6	O	M F	D P	1	
	7	O	M F	D	1	1
5	8	O	M	CF		1
	1	O	M F	CM	D P	1
	2	O	M F	D		1
	3	O	M F			1
	4	O	M F	D		1
6	5	S				
	6	O	F		1	
	7	O	M			1
	8	O	M F	D		1
	1	O	M F	CF	D	1
7	2	O	M F			1
	3	O	M F			1
	4	S O		SS		
	5	S O	F	CF	D2	1
	6	O	M F			1
8	7	O	M F			1
	8	S O		S		1
	1	S		P		
	2	O	M F		1	1
	3	O	M F			1
9	4	S O		S		
	5	S O		S		
	6	O	M			1
	7	S				
	8	O	M F		1	1
10	1	U				
	2	O	M F		1	1
	3	U	M			M
	4	O	M F	D	1	1
	5	O	M F	CM	1	1
11	6	O	M		1	1
	7	O	M F		1	1
	8	S		D H	1	1
	1	O	M F	D	1	1
	2	O	M F	CM		1
12	3	O	M F	CM		1
	4	O	M F		D	1
	5	O	M			1
	6	O	M F		D	1
	7	O	M F		P	1
13	8	O	M F	CF		2
	1	S O		SS		2
	2	O	M F			1
	3	O	M F			1
	4	O	M F	CF		1
14	5	O	M F		D	1
	6	O	M F	CF	D	2
	7	O	M			1
	8	O	M			1
		O	M			1

CENSUS OF WILBERFORCE BARRACKS COMPOUND—*contd.*

Hut.	Room.	Defn.	Occupants.	Animals.	Beds.	Oedema.
					U. S.	
10	1	S		P		
	2	O	M S		1 1	M
	3	O	M F	D	2	
	4	O	M CF		2	
	5	O	M F		1	
	6	S				
	7	O	M F		1 1	M (Kissy)
	8	O	M		1	
11	1	U		P		
	2	O	M F		1 1	
	3	O	M F		1 1	
	4	O	M F CM		1 1	
	5	S		P		
	6	U				
	7	O	M F		1 1	
	8	O	M F		1 1	
12	1	S				
	2	O	M F		1 1	
	3	O	M F		1	
	4	O	M F CF			
	5	S		H		
	6	O	M F	D	1	
	7	O	M F		1 2	
	8	S O		SS	2	
13	1	O	M F CF	D	1 1	
	2	O	M	D	1 1	
	3	O	M		1	M
	4	O	M F			M F
	5	S				
	6	O	M S		1 1	
	7	O	M F CM	D P	1	
	8	O	M F S	P	1 1	
14	1	O	M F		1 1	M
	2	O	M F		1 1	F
	3	O	M F		1	
	4	O	M F		2	M F
	5	O	M F		1 1	
	6	O	M F		1 1	
	7	S O		SS	2	S
	8	O	M F		1 1	
15	1	S				
	2	O	M F		2	M F
	3	O	M F CF	D P	1 1	
	4	O	M F		1	
	5	O	M		1 1	
	6	O	M S		1 1	
	7	O	M F		1 1	
	8	O	M F CF	D	1 1	M
16	1	O				
	2	O				
	3	O				
	4	O				
	5	S				
	6	O	M		1	
	7	O	M F CM CF	P	1 1	F
	8	O	M F		1 1	M
17	1	O	M F CM		1 1	
	2	S O		S	1	
	3	O	M F		1	F
	4	O	M F		1 1	
	5	S				
	6	S				
	7	O	F CM		2	M (Kissy)
	8	O	M F CF		2	M
18	1	S				
	2	O	M F	D	1 1	
	3	O	M F		1	
	4	S O		S	1	
	5	O	M F		1 1	M
	6	O	M F		1 1	
	7	O	M F		1	
	8	O	M F CF	D	2	

CENSUS OF WILBERFORCE BARRACKS COMPOUND—*contd.*

Hut.	Room.	Defin.	Occupants.	Animals.	Beds.	Oedema.
					U. S.	
19	derelect					
20	1	O	M F	D	1 1	F
	2	O	M F		1	
	3	O			1 1	
	4	O	M F		1	M
	5	O	M F CM		1	
	6	O	M		1	
	7	O	M F CF CF		1 1	
	8	O	M F CM		1 1	
21	1	O	M F		1	M
	2	O	M		1	
	3	O	M F		1	
	4	O	M F		1	
	5	S O		S	1	
	6	O	M		1 1	
	7	O	M F	D	1	
	8	O	M		1 1	M
22	1-4	O	M FF CM S	D	1 2	
	5-6	O	M	D	2	
	7-8	U				
23	1	O	M F		1	
	2	O		S	1	
	3	O	M F		1	
	4	S				
	5	O	M	D		
	6	S O	F	CF	1	
	7	O		S	1	
	8	S O		S		
24	1	O	M	D		
	2	O	FFF	P	2	
	3	O	M F		1	
	4	U				
	5	O		SS	2	
	6	O	M		1	
	7	O	F	S	1	
	8	O		S		
25	1	U			1	
	2	O	M		2	
	3	O	F	CF	D	I
	4	S				
	5	O		S	1	
	6	O		S	1	
	7	O		S		
	8	O	F	S		
26	1	O		S	1	
	2	O	M		1	
	3	O	M	S	1	
	4	O	M	S	1	
	5	S			1	
	6	O	F CF CF	H	2	
	7	O	F CM	P	1	
	8	S O	M		1	
27	1	O		S	1	
	2	O				
	3	O		S	1	
	4	O		S	1	
	5	O		SS	2	
	6	O		S	1	
	7	O	M S		1	F
	8	O	F	SSS	1	S
28	1	O	M F	D	1	
	2	O				
	3	O	M		1	
	4	O	F		1	
	5	O	M F CF		1	
	6	O	FFF		1	FF
	7	S O	M F		1	
	8	O		CF	1	

CENSUS OF WILBERFORCE BARRACKS COMPOUND—*contd.*

Hut.	Room.	Defin.	Occupants.	Animals.	Beds.	Oedema.
					U. S.	
29	1	O	M F S		1	
	2	O			1	
	3	O	M		1	
	4	O		S	1	
	5	O		S	1	
	6	O	M F	D	1	1
	7	O	M F CF	P	1	1
	8	S				
30	1	O	M		1	
	2	O	M		1	
	3	O	M F CM CF S	D	1	M
	4	O	F		1	
	5	S				
	6	O	F		1	
	7	O	M F		2	
	8	O			1	
31						
32	1	U S				
	2	U K				
	3	U				
	4	U				
	5	O		S	1	
	6	O	M	DP		1
	7	O	M	P	3	
	8	S		H		
33	1	O	M		1	
	2	O	F CM		1	
	3	U				
	4	K				
	5	O	M F		3	F
	6	O				
	7	O	M			M
	8	O				
34	1	O				
	2	O			1	
	3	O			1	
	4	O	M	D	1	
	5	O	M F		1	
	6	O	M F		1	
	7	O	M F		1	
	8	O				
35	1	O	M F S	D	1	
	2	O				
	3	O	M F		1	
	4	S				
	5	O	M F		1	F
	6	O	M F		1	
	7	O	FF		1	
	8	O	M		1	
36	1	S			1	
	2	S				
	3	O	M		2	
	4	O	M F CM	P	1	
	5	O	M S		2	
	6	O	M F	P	1	
	7	O	F CM		1	
	8	O	M	D	1	
37	1	S				
	2	O	M F		1	F
	3	O	F	D	1	
	4	O	M		1	
	5	O	M F CM		1	
	6	O			1	
	7	O	M	D	1	
	8	O	F		1	

CENSUS OF WILBERFORCE BARRACKS COMPOUND—*contd.*

Hut.	Room.	Defin.	Occupants.	Animals.	Beds.	Oedema.
38	1	O	M F		U. S. 1	
	2	O	M F		1	
	3	O	M F		1 1	
	4	O	M F CF		1	
	5	O	M F		1	
	6	O	M F		2	
	7	O	M F		1 1	
	8	O	M F		2	
39	1-8	O	M F CF S			F
	2-7				2	
	3-6	O			1 1	
	4-5	O	M M		2	
40	1	O			1	
	2	O	M F CF	P	1	
	3	O	M F		1	M
	4	S		P		
	5	S				
	6	O	M CM CM		1	
	7	O	M F CM		1	
	8	O	M F		1	
41	1	U				
	2	U				
	3	U				
	4	U				
	5	S				
	6	O	M F CM		1	
	7	S	M			
	8	O	M		1	
42	1	U		P		
	2	O	M		1	
	3	U				
	4	U				
	5	U		H		
	6	S O			1	
	7	O	M F	P	1	
	8	U			1	
43	1	U				
	2	U				
	3	U				
	4-5-8	O	M CM S		1 1	
44	1-6	U		H		
45	1	U				
	2	O	M		1	
	3	O	M F CF		1 1	
	4	O	M F CF		1 1	
	5	O	M		1	
	6	O			1	
	7	O	M CF CF S		1	
	8	O	M CF CF		2	
46	1	O			1 1	
	2	O	M F CF CF CF	P	1	
	3	U				
	4	S O			1	
	5	O			1	
	6	O	M		1	
	7	O	M F		1	
	8	O	M F			1
47	1	U				
	2	O	M F		1 1	M
	3	O	M S		1 1	
	4	S				
	5	O	M F		1	
	6	O		SS		1
	7	O	M			
	8	O	M F CM		1	

CENSUS OF WILBERFORCE BARRACKS COMPOUND—*contd.*

Hut.	Room.	Defin.	Occupations.	Animals.	Beds.	Oedema.
					U. S.	
48	1	O	M		1 1	
	2	O	M F		1 1	
	3	O	M F CF		1 1	
	4	O	M F CM CM S		1	
	5	O	M F		1	
	6	O				
	7	O	M		1	
	8	O	M		1	
49	K					
50	1-4	U				
	5-8	O	M F CM CM S		2	
51	1	O	M		1	
	2	O	M F		1 1	
	3	O	M			
	4	O	M F		1	
	5-8	U				
52	1	O	M F		1	
	2	O	M		1	
	3	O	M		1	
	4	O	M F CF		1 1	
	5	U				
	6	O	M F		1 1	
	7	O	M F		2	
	8	U				
53	1	O		SS	1	
	2	O	M		2	
	3	O	M CF CF	H	1 1	
	4	O	M		1	
	5	K		D		
	6	O	M	P	1	
	7	O	F CF CF		1	
	8	O			1	
54	1	O			1	
	2	O	M CM S		1 1	
	3	O	M S		1	
	4	O	M F CM	D	2	
	5	O	M F		1 1	
	6	O	M F		1	
	7	O	M		1	
	8	O	F CF CF CF	H3	1	

KEY.

Defin—Use to which hut is put.
O=Occupied. U=Unoccupied.
S=Store. K=Kitchen.
Occupants—M=Adult Male. F=Adult Female.
CM=Child Male. CF=Child Female.
S=Servant.
Animals—H=Guinea Pigs. D=Dogs.
P=Poultry.
Beds—S=Screened. U=Unscreened.
Oedema—Number of Oedema cases in hut.

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NOTE BY THE DIRECTOR OF MEDICAL AND SANITARY SERVICE
ON THE CIRCUMSTANCES IN 1931 WHICH LED UP TO THIS
INVESTIGATION.

At the end of 1930, the Superintendent of Prisons made his usual annual contract for the supply of paddy to be milled in the Freetown Prison for use at the Freetown and Kenema Prisons, the Hospital, Asylum and Infirmaries, and received an excellent quality of new season's crop from the C.F.A.O. He was then asked to make a contract on behalf of the R.W.A.F.F., and contracted with another firm for 11,000 bushels. This firm purchased the quantity from Syrian middlemen. The first consignment of this contract, delivered at the Prison in January 1931 was good. The second, in February, was dusty and contained a mixture of old and new crops. The Superintendent of Prisons protested, but his protest was ignored. He estimated the consignment to contain about 75 per cent. old and 25 per cent. new rice.

This rice was supplied to the R.W.A.F.F. and issued from their store in March. At the beginning of April a strong protest was made by the Officer Commanding: the soldiers were refusing the rice on the grounds that it was causing "belly-sickness". In consequence of this the Superintendent of Prisons commenced issuing his good C.F.A.O. rice to the R.W.A.F.F., as well as to the institutions.

On 2nd May, the Superintendent of Prisons went on leave and in his written instructions to the Assistant Superintendent said that no more of this inferior rice was to be accepted from the second firm. At that time there were nearly 6,000 bushels of this rice stored at the Prison. Soon it became evident that the good C.F.A.O. rice would shortly become exhausted, and the Acting Superintendent of Prisons endeavoured to eke it out by alternating the two stocks weekly or so. The first case of "beri-beri" was reported from the Prison in May.

The issues to Kenema Prison were, March, fifty bushels new rice (C.F.A.O.) May, forty bushels, uncertain from which stock, and July, fifty bushels of the inferior stock. The first case of "beri-beri" at Kenema prison was reported in August. The Medical Officer immediately increased the vitamin content of the dietary, at the same time severely criticising the quality of rice supplied. Cases kept on occurring up to the 9th September, a total of fourteen with three deaths. On 2nd September the Acting Superintendent of Prisons milled a quantity of new rice and despatched it to Kenema. There were no more cases at that Prison.

On May 11th, the second firm appealed to Government against the Superintendent of Prisons' refusal to take delivery of the balance of his contract, some 3,000 bushels. After correspondence and conferences, the Acting Superintendent of Prisons took delivery in July of 1,640 bushels. Part of this was milled and supplied to the R.W.A.F.F. on August 19th for issue in September. The outbreak of oedema at the Barracks shows:

September	...	...	...	1 case
October	...	...	...	11 cases
November	...	...	...	14 cases

The outbreak at the Asylum at Kissy commenced in August and continued month by month with increasing severity. It is not recorded from which source the consignments of rice to this Institution were taken. It appears probable that the defective rice was first supplied to the Asylum in July and intermittently thereafter. Many of the patients are feeble physically as well as mentally and succumbed easily to the attack.

The Superintendent of Prisons and I returned from leave at the beginning of October, and when the state of affairs was known to us, conferred on the subject. It was plain that the disease was not an avitaminosis—the heavy additions of vitamins to the dietary in each outbreak had made no difference to the incidence. In fact the Superintendent of Prisons had strongly opposed the diagnosis of beri-beri in the outbreak of 1929. The coincidence of all the four outbreaks of 1931 occurring in close relation to each other, and the fact that the supply of rice from one source was the only known point common to all of them strongly indicated that this rice was the origin of the trouble. It was undoubtedly of poor quality, a mixture of 1929–30 and 1930–31 crops, and had been also infested with weevils. It was thought probable that the cause might prove to be a toxin in the diseased rice, and Dr. Burnett was invited to make an investigation on those lines.

A point of considerable interest, in view of Dr. Burnett's conclusion on the results of washing the deteriorated rice, arises from the fact that at the Male and Female Infirmaries, housing fifty-five and thirty-five inmates, respectively, mostly old and many paraplegic, and supplied with rice jointly with the Asylum, not a single case of this form of oedema occurred. On investigation, it was found that the cooks (Africans), dissatisfied with the quality of the rice supplied, gave it three washings, the first two being more in the nature of soakings. This undoubtedly saved many lives.

J. C. S. McDOUALL,
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Plague, Pneumonia, Cholera, Typhus, Smallpox, Chickenpox (Varicella), Yellow Fever, Blackwater Fever, Relapsing Fever, Continued Fever, Puerperal Fever, Typhoid and Paratyphoid Fever, Dysentery, (Amœbic and Bacillary), Beri-Beri, Tuberculosis, Leprosy, Cerebro-Spinal Meningitis, Sleeping Sickness, Acute Poliomyelitis, Influenza, Erysipelas, Mumps (Infective Parotitis), Diphtheria, Membranous Croup, Scarlatina or Scarlet Fever.

